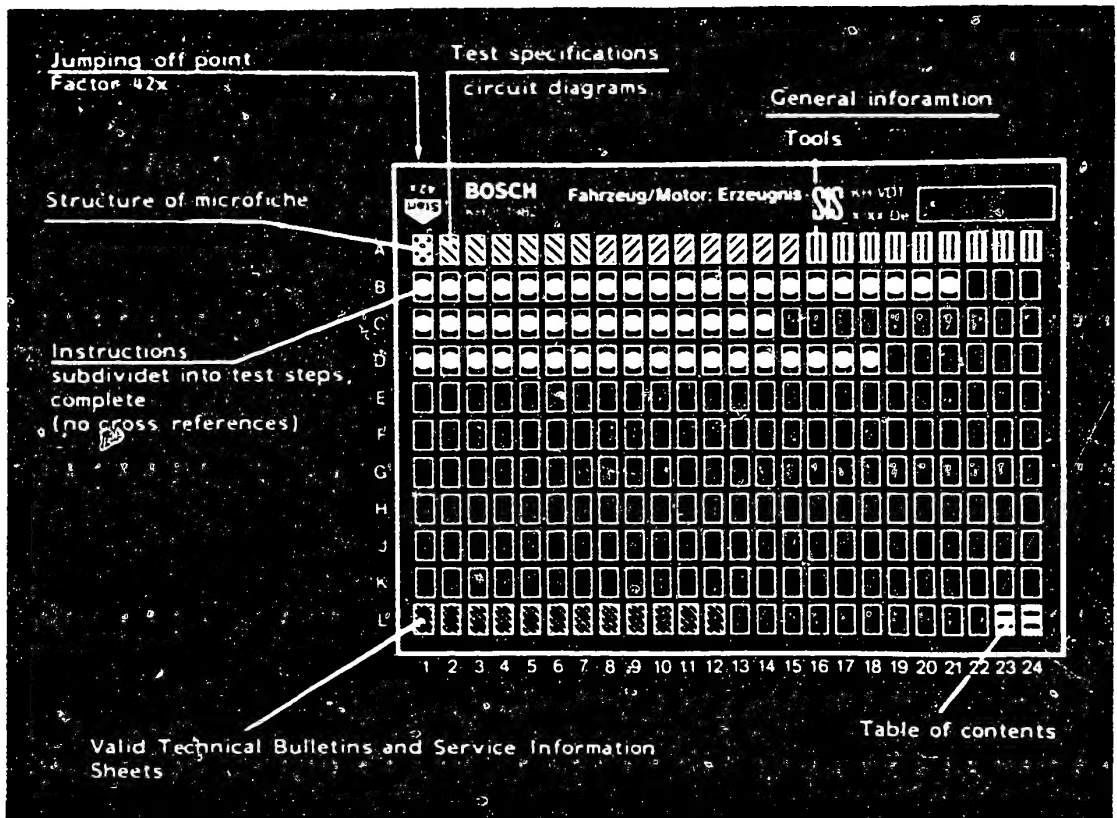


Structure of microfiche



1. Read from left to right

2. Title of microfiche (appears on each coordinate)

E 16	Product/assembly/test step	
	Vehicle/engine	

Coordinate

3. Limits of section



Beginning



Mid-section



End



One-page section

4. References to relevant test steps in test specifications; coordinate e.g. C6

C 6

A1

Repair and testing



1. Test specifications - electrical

Suppression capacitor 1.8...2.6 μ F

Regulated voltage Load current \leq 10 A

B2

Regulator Part Number	Regulated voltage V
0 192 052 001	13.7 ... 14.5
0 192 052 002	13.7 ... 14.5
0 192 052 004	13.7 ... 14.5
0 192 052 005	13.7 ... 14.5
0 192 052 006	13.7 ... 14.5
0 192 052 007	13.7 ... 14.5
0 192 052 008	13.7 ... 14.5
0 192 052 010	13.7 ... 14.5
0 192 052 011	13.7 ... 14.5
0 192 052 012	13.7 ... 14.5
0 192 052 013	13.7 ... 14.5
0 192 052 014	13.7 ... 14.5
0 192 052 015	13.7 ... 14.5
0 192 052 016	13.7 ... 14.5
0 192 052 017	13.7 ... 14.5
0 192 052 018	13.7 ... 14.5
0 192 052 019	14.3 ... 14.9
0 192 052 020	13.7 ... 14.5
0 192 052 021	13.7 ... 14.5
0 192 052 022	13.7 ... 14.5
0 192 052 023	14.3 ... 14.9
0 192 052 024	13.7 ... 14.5
0 192 052 025	13.7 ... 14.5
0 192 052 026	13.7 ... 14.5

A2

Test specifications - electrical

Alternators 0 120 400..., 0 120 489...,14V



Regulated voltage (continued)

Regulator part number	Regulated voltage V
1 197 311 001	13.7 ... 14.5
1 197 311 002	14.1 ... 14.9
1 197 311 003	13.7 ... 14.5
1 197 311 004	13.7 ... 14.5
1 197 311 005	13.7 ... 14.5
1 197 311 006	13.7 ... 14.5
1 197 311 007	14.1 ... 14.9
1 197 311 008	14.1 ... 14.9
1 197 311 009	13.7 ... 14.5
1 197 311 010	13.7 ... 14.5
1 197 311 011	13.7 ... 14.5
1 197 311 100	14.3 ... 14.6



Power test

Resistance values - stator

Resistance values - rotor

For power test with regulator keep regulated voltage at 13V.

D1

B9

B16

Alternators 0 120 400 .. 0 120 489 ..	Power test		Resistance values	
	Speed ¹⁾ min-1	Load A	Stator $\Omega + 10\%$	Rotor $\Omega + 10\%$
K1(RL)7V50A17	1400	20	0.1	1.0
	1700	34		
	4000	50		
K1(RL)7V50A19	1300	20	0.1	1.0
	1900	34		
	6000	50		
K1(RL)14V28A22	1500	10	0.26	4.0 ⁵⁾
	2200	18		
	6000	28		
K1(RL)14V32A22	1500	10	0.1	7.0
	2200	21		
	6000	32		
K1(RL)14V35A20	1300	10	0.26	4.0 ⁵⁾
	2000	23		
	6000	35		
K1(RL)14V35A21	1500	12	0.26	5.2
	2000	20		
	6000	35		
K1(RL)14V35A22	1400	10	0.2	4.0 ⁵⁾
	2200	23		
	6000	35		

1) Warmed-up alternator (60°C) with regulator

5) For alternators with transistor regulator 3.4 or 2.9 Ω applies.

A4

Test specifications - electrical

Alternators 0 120 400..., 0 120 489..., 14V



Power test and resistance values (continued)

Alternators 0 120 400 .. 0 120 489 ..	Power test		Resistance values	
	Speed ¹⁾ min ⁻¹	Load A	Stator $\Omega + 10\%$	Rotor $\Omega + 10\%$
K1(RL)14V43A21	1250	10	0.18	4.0 ⁵⁾
	2100	28		
	6000	43		
K1(RL)14V45A20	1250	10	0.18	4.0 ⁵⁾
	2050	30		
	3550	40 ⁹⁾		
K1(RL)14V45A22	6000	45	0.17	4.0 ⁵⁾
	1400	10		
	2200	30		
K1(RL)14V45A24	3450	40 ⁹⁾	0.15	4.0 ⁵⁾
	6000	45		
	1550	10		
K1(RL)14V50A21	2400	30	0.11 - 0.14 ¹⁰⁾	4.4 - 4.9 ¹⁰⁾
	3850	40 ⁹⁾		
	6000	45		
K1(RL)14V50A22	1350	10	0.13	4.0 ⁵⁾
	2150	33		
	2850	40 ⁹⁾		
K1(RL)14V55A20	6000	50	0.14	4.0 ⁵⁾
	1400	10		
	2200	33		
	2850	40 ⁹⁾		
	6000	50		
	1200	10		
	2000	36		
	2350	40 ⁹⁾		
	6000	55		

- 1) Warmed-up alternator (60°C) with regulator
5) For alternators with transistor regulator 3.4 or
9) 2.9 Ω applies.
9) On test bench EFAW 275 and KPS 001.00 test only up to
this value.
10) No further tolerance given.



Power test and resistance values (continued)

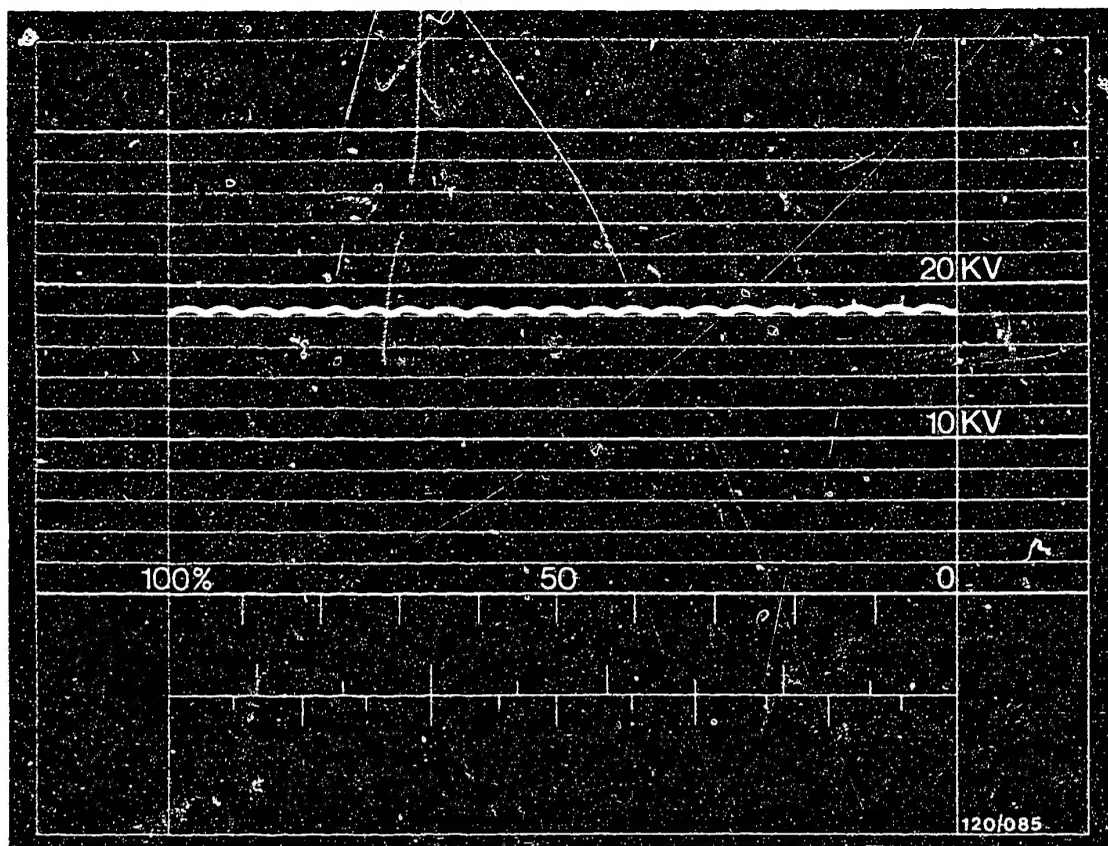
Alternators 0 120 400 .. 0 120 489 ..	Power test		Resistance values	
	Speed ¹⁾ min ⁻¹	Load A	Stator $\Omega + 10\%$	Rotor $\Omega + 10\%$
K1(RL)14V55A22	1350	10	0.13	4.0 ⁵⁾
	2200	36		
	2450	40 ⁹⁾		
	6000	55		
K1(RL)14V65A21	1400	20	0.1	2.8
	2100	44		
	6000	65		
K1(RL)14V65A24	1500	10	≤ 0.1	3.4
	2450	43		
	6000	65		
K1(RL)14V70A20	1500	27	<0.1	2.8
	2000	46		
	6000	70		

1) Warmed-up alternator (60°C)

5) For alternators with transistor regulator 3.4 or 2.9 Ω applies.

9) On test bench EFAW 275 and KPS 001.00 test only up to this value.





Oscilloscope display OK

If the alternator is OK, the above oscilloscope pattern will be displayed. The DC output has a slight ripple. The pattern can exhibit small peaks when the voltage regulator comes into operation. The regulator can be stopped by means of switching in loads (e.g. load resistor).

Adjust the pattern height so that the ripple is contained between two adjacent kV lines.

In order to be able to compare such patterns, the pattern concerned is to be adjusted with the vertical control of the oscilloscope so that it fits approximately between the 10 kV and 20 kV lines.

Note: more than one defect can be present at one time.



2. Test specifications - mechanical

True-running error

O.D. of rotor 0.05 mm
O.D. of collector rings 0.03 mm

B12

Minimum dia. of collector rings
(see table)

B3

Minimum projection of carbon brushes
(see table)

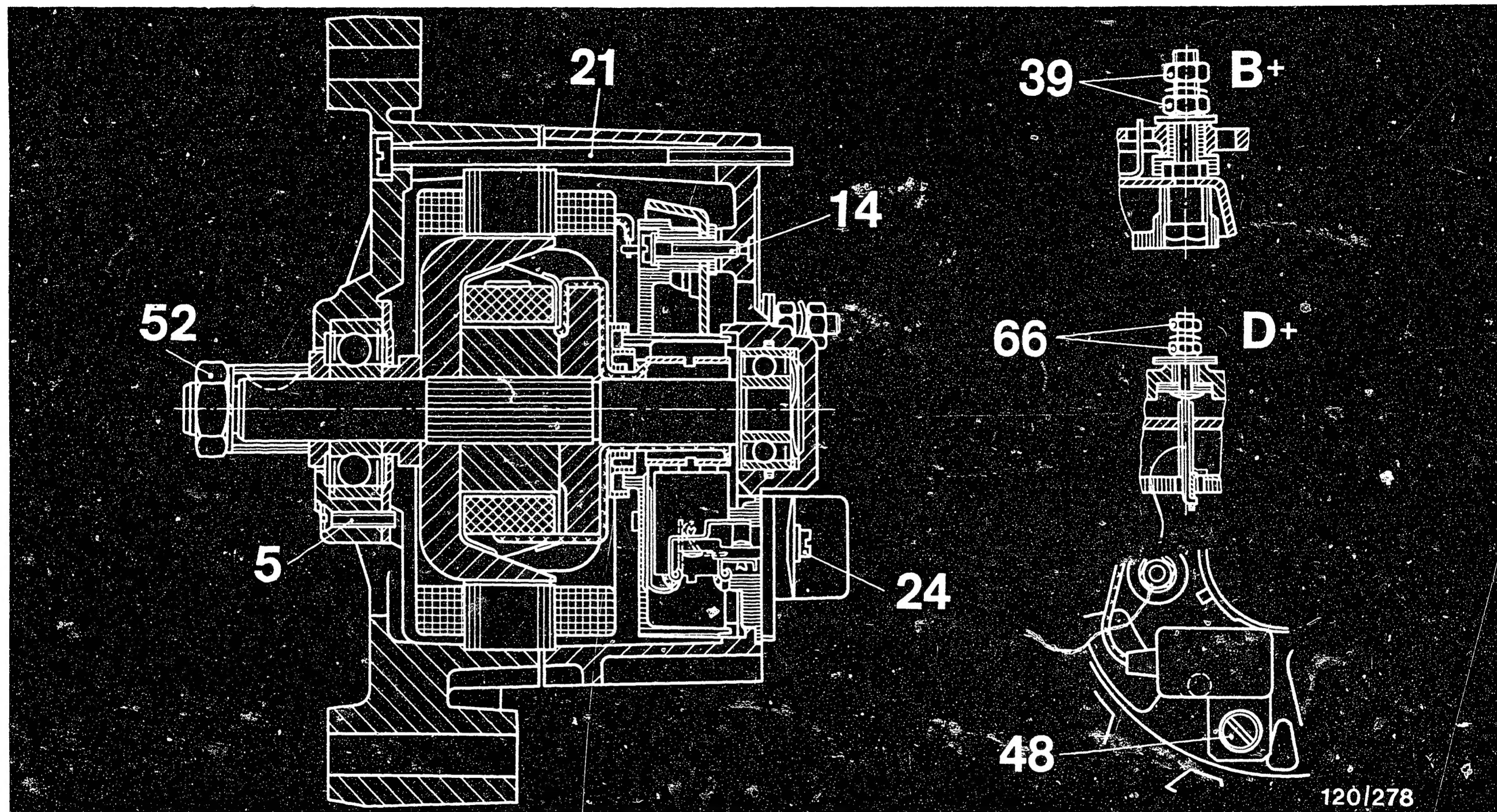
Alternators	Slip ring dia. (mm)		Brush projection (mm)	
	New	Min.Ø	New	min.
with EE regulator 0 192 052 ..				
0 120 489 ..	27.8	26.8	14	5.0
0 120 489 ..	32.5	31.5	10	5.0
with EL regulator 1 197 311 0 ..				
0 120 489 ..	27.8	26.8	12...13	5.0
0 120 489 ..	32.5	31.5	11...12	5.0
with EM regulator 1 197 311 1..				
0 120 489 ..	27.8	26.8	12...13	5.0
with separately-mounted regulator 0 192 ..				
0 120 400 ..	27.8	26.8	14	5.0
0 120 400 ..	32.5	31.5	10	5.0
0 120 400 836	27.8	26.8	10	5.0

A8

Test specifications - mechanical

Alternators 0 120 400..., 0 120 489..., 14V





Tightening torques

Item 5 = 2.4 ... 3.5 Nm
 Item 14 = 1.4 ... 2.0 Nm
 Item 21 = 4.1 ... 5.5 Nm
 Item 24 = 1.6 ... 2.3 Nm

Item 39 = 4.8 ... 6.8 Nm (B+)
 Item 48 = 2.9 ... 4.1 Nm (suppression capacitor)
 Item 52 = 35 ... 45 Nm
 Item 66 = 1.6 ... 2.3 Nm (D+)

A9

Test specifications - mechanical

Alternators 0 120 400..., 0 120 489..., 14V

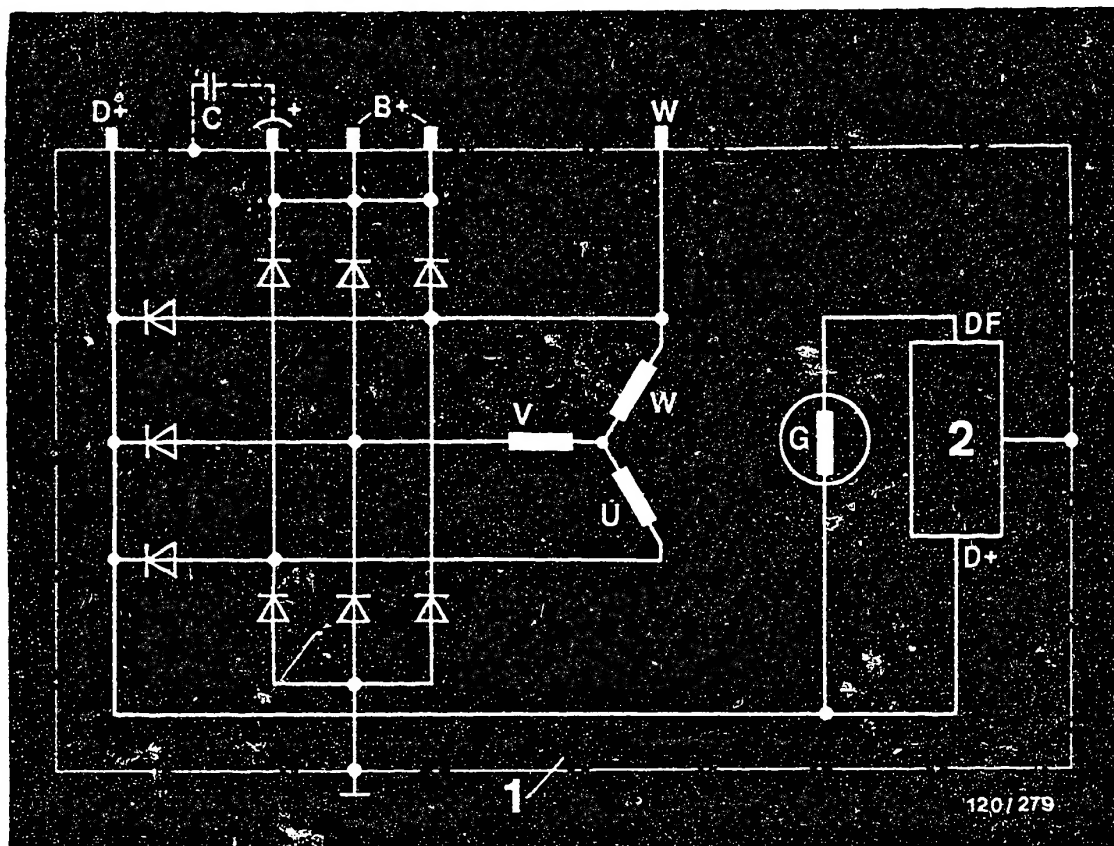


A10

Test specification - mechanical

Alternators 0 120 400..., 0 120 489..., 14V

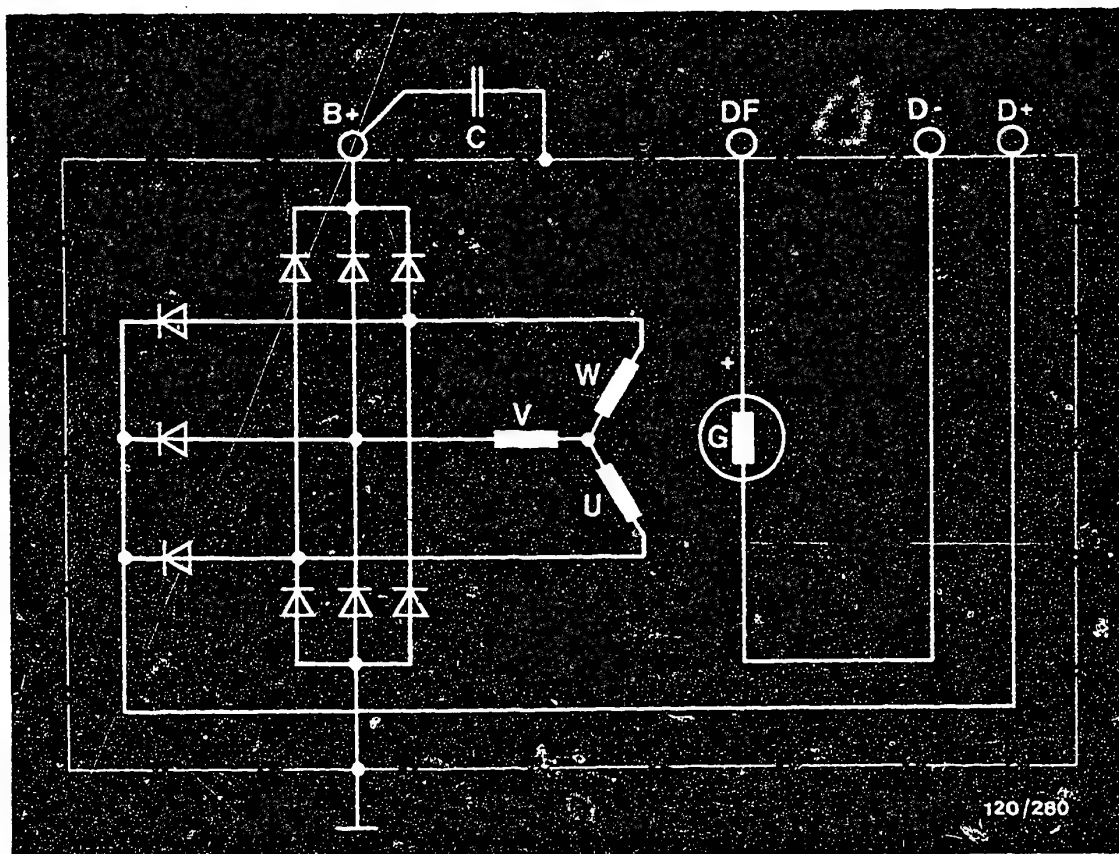




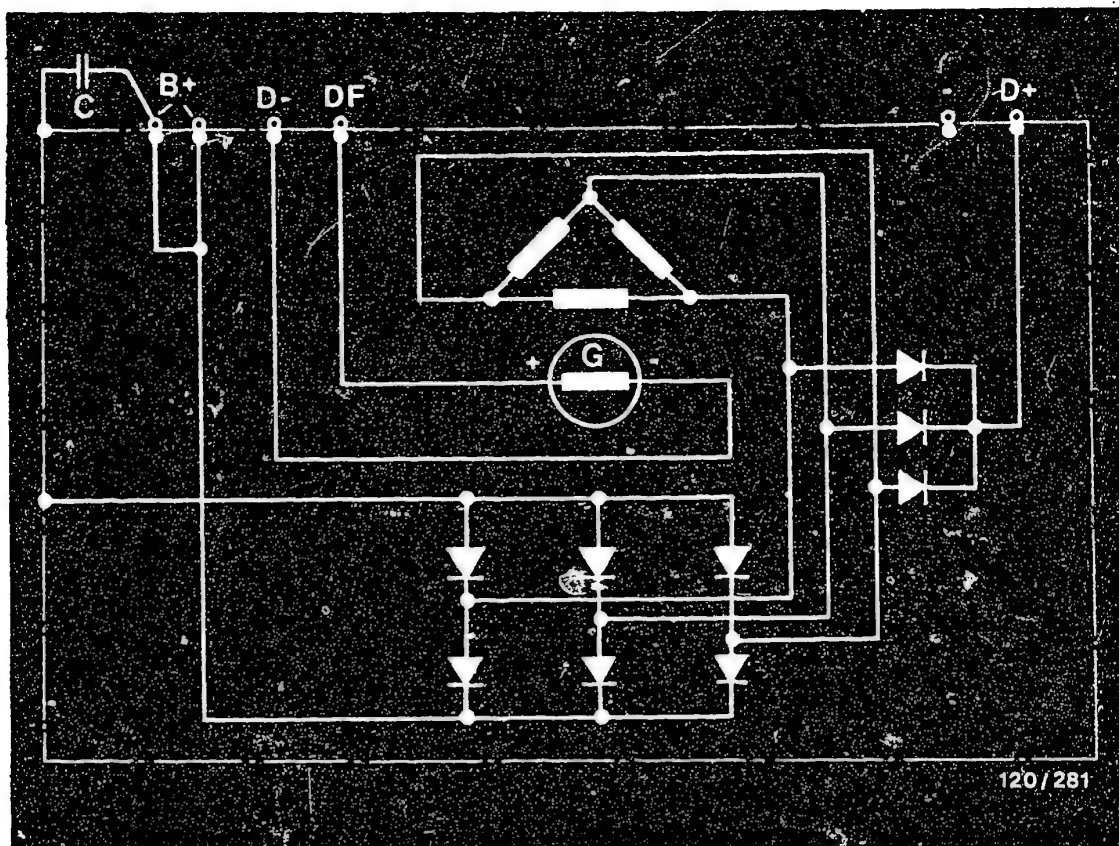
- 1 = Alternator
- 2 = Attached-type regulator

Circuit diagram of K1 alternator 0 120 489.. up to 65A
with terminal W and attached-type regulator
 (terminal W is not always present)





Circuit diagram of K1 alternator 0 120 400 .. up to 65A
with separately-mounted regulator



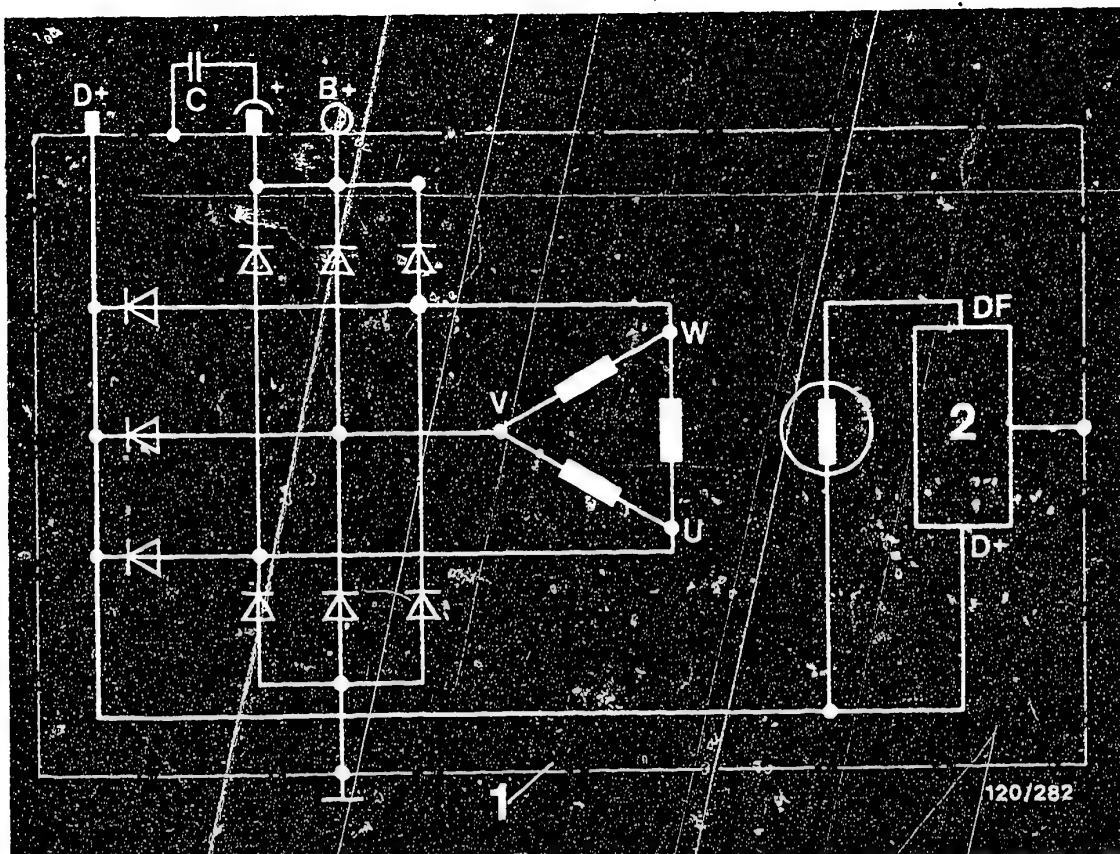
Circuit diagram of K1 alternator 0 120 400..., 65A with separately-mounted regulator

A13

Circuit diagram

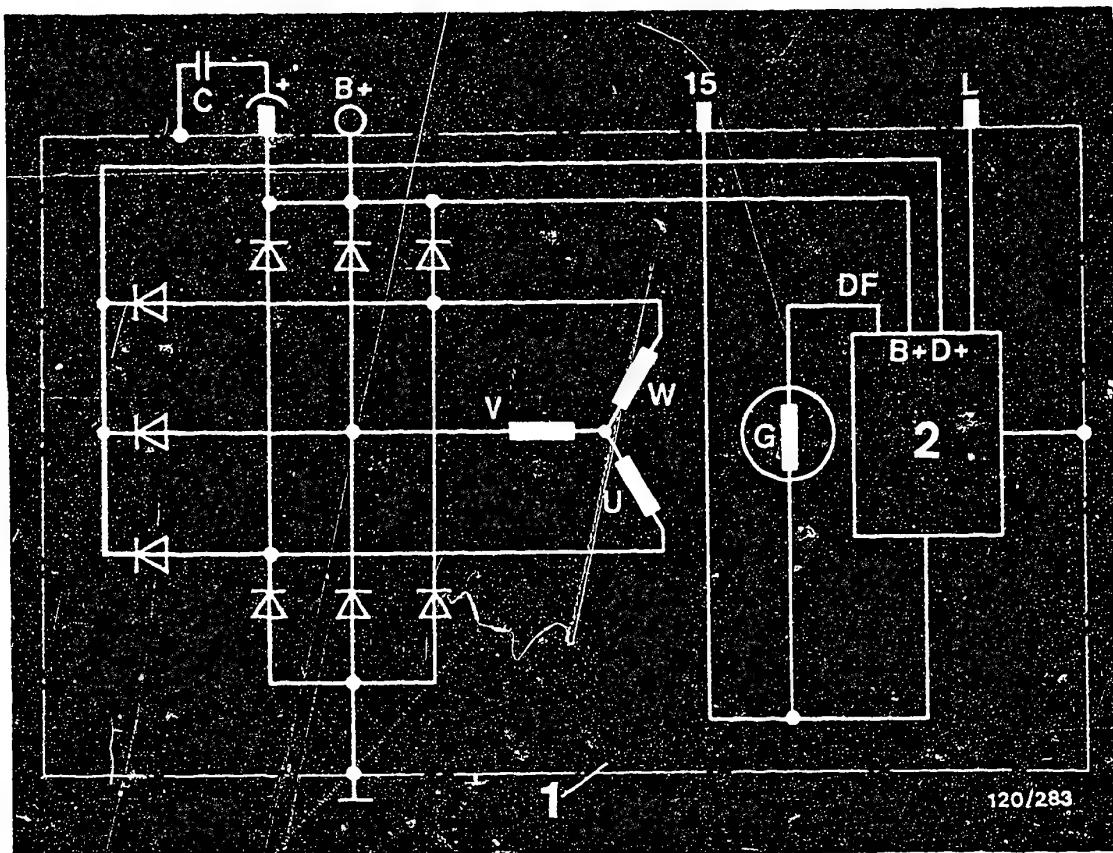
Alternators 0 120 400..., 0 120 489..., 14V





- 1 = Alternator
2 = Attached-type regulator

Circuit diagram of K1 alternator with delta connection,
0 120 489..., 70A with attached-type regulator



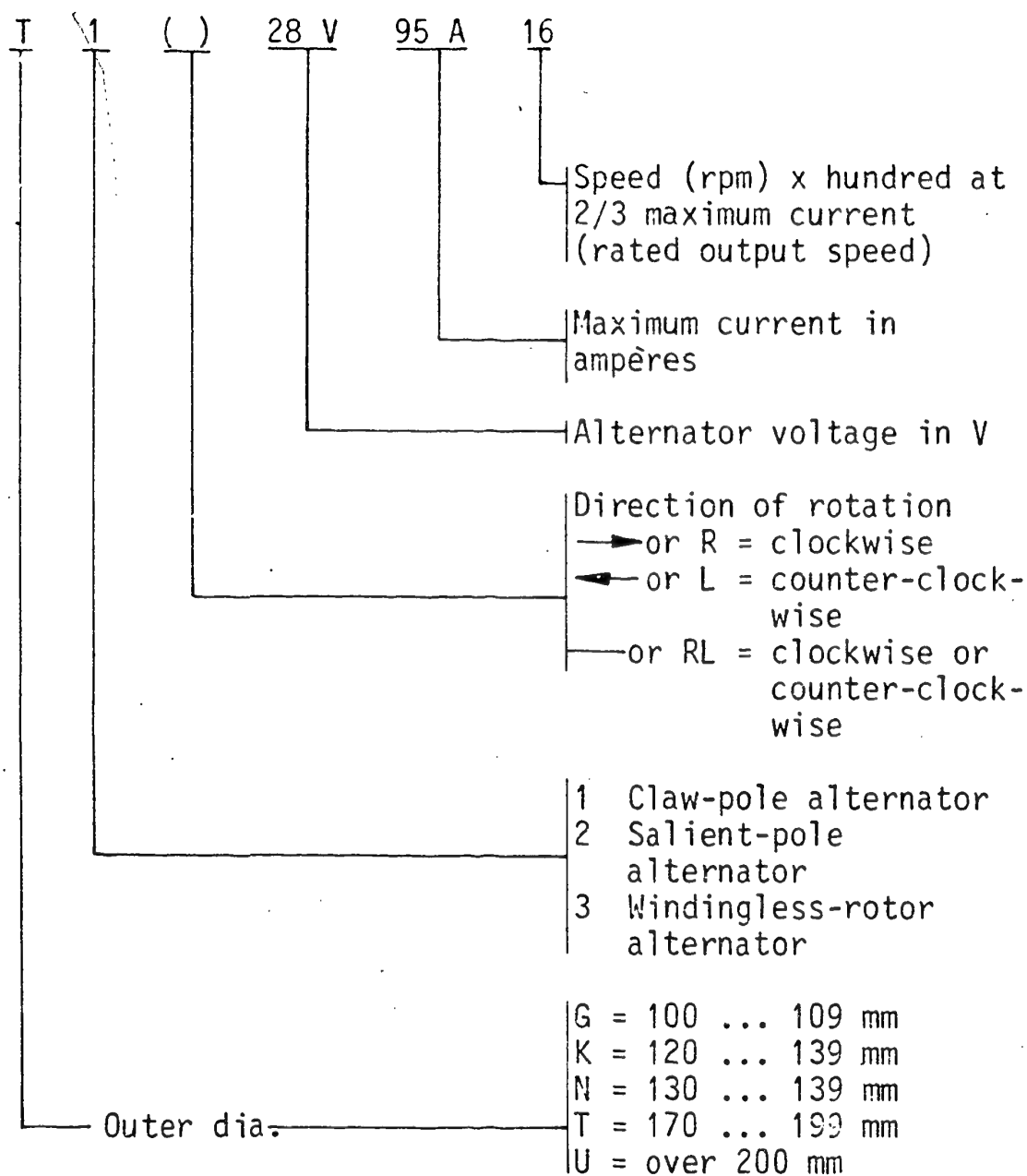
- 1 = Alternator
 2 = Attached-type regulator
 L = Connection for fault-indication lamp

Circuit diagram of K1 alternator 0 120 4.. with EM
 attached-type regulator 1 197 311 1..



4. General Instructions

Explanation of type code on alternator



Cleaning the parts

C A U T I O N ! F I R E H A Z A R D !

Alternators are being increasingly fitted with long-storage capacitors (e.g. for the interference suppression of receivers and transmitters).

When washing parts of the alternator it is possible for the capacitor to discharge when immersed in cleaning fluids, there then being the danger that inflammable liquids will ignite. For this reason, parts with capacitors must only be washed in tri- or perchloro-ethylene.



5. Test equipment, tools and adhesives

5.1 Test equipment

Alternator test bench	EFLI 91 ..	0 683 300 100
or	EFLJ 25 ..	0 680 110 ...
or	EFLJ 70 A	0 680 104 ...

or combination test bench
(only for loading up to
max. 43 A)

EFAW 275 ..	0 681 107 ...
-------------	---------------

Mounting plate for mounting swivel-arm- mounted alternators on alternator test bench	EFLJ 66/3 EFLJ 25, 70
---	------------------------------

Parts set for mounting swivel-arm- mounted alternators on combination test bench	1 687 000 042 EFAW 275 ..
--	----------------------------------

For additional test:

Ignition oscilloscope	(all models)
-----------------------	--------------

or

Bosch Motortester	(all models)
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Test equipment (continued)

Test panel	EFAW 81 or KDAW 9984	0 681 169 013
Transformer panel	EFAW 82 or KDAW 9985	0 681 169 014
Insulation test- er or test prods	EFAW 84 KDAW 9983	(Included with EFAW 81 or KDAW 9984)
Dial indicator	EFAW 7	1 687 233 011
Magnetic instrument stand	T-M1 (EW/MS 1 B 1	4 851 601 124 0 601 980 001)
Alternator tester	EFAW 192 or WPG 012.00	0 681 101 403 0 684 201 200
3 Feeler gauges 0.15 ... 0.6 mm	KDZV 7399	
Electric tester	ETE 014.00	0 684 101 400



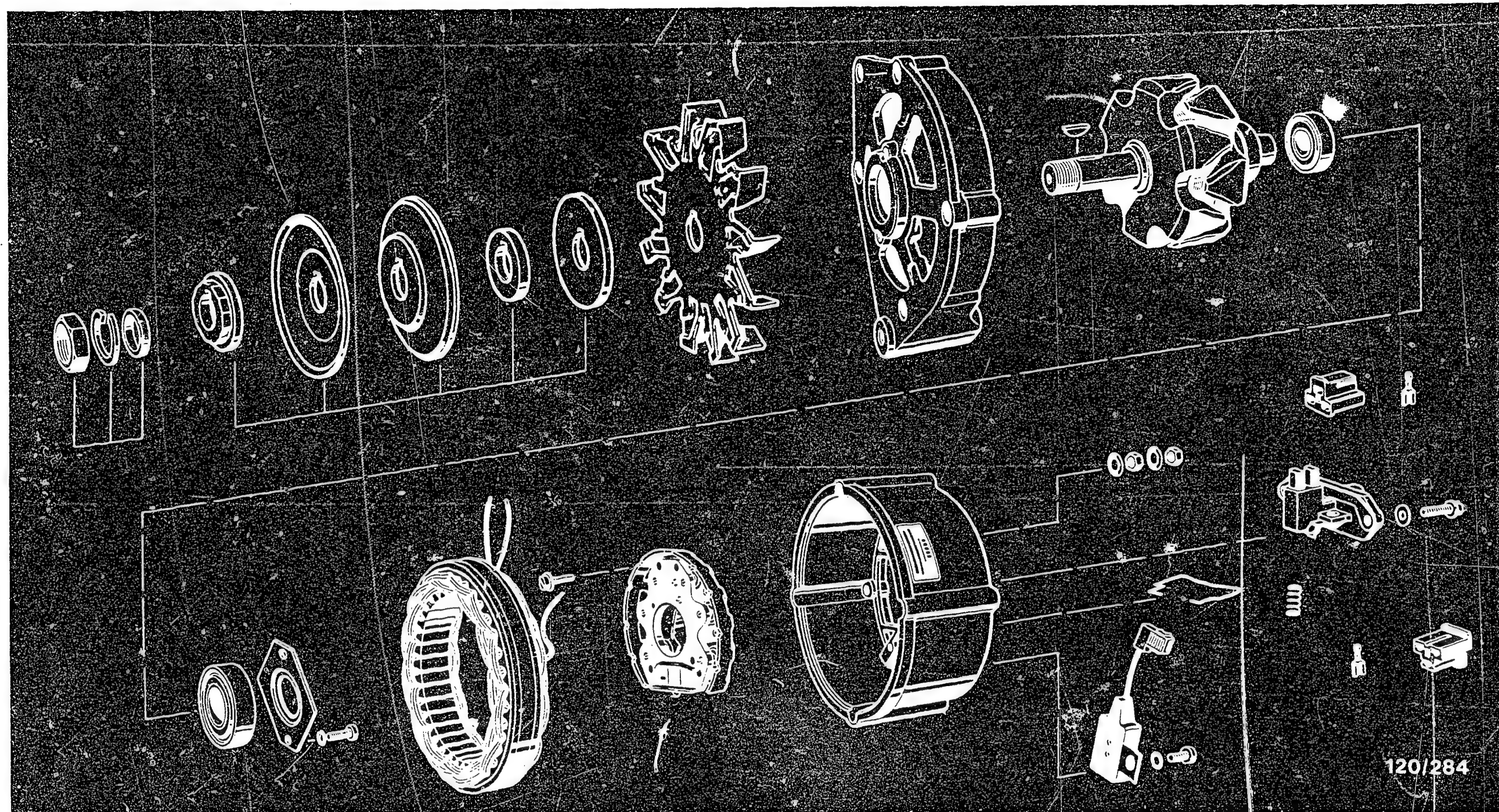
5.2 Tools

Press-on mandrel	KDLI 6002
Press-on mandrel for collector rings	KDLI 6004/1 KDLI 6004/0/1
Locking device for pulley	KDLI 6006
Clamping pin for arbor press	KDLI 6010
Press-on mandrel for collector-ring end shield	KDLI 6499/0/3
Clamping support	KDAW 9999
Arbor press	(commercially available)
Two vee blocks	(commercially available)
Soldering iron 180 W	(commercially available)
Puller for collector rings	(commercially available)
Punch	(commercially available)
Press-out ring e.g. old starting motor housing, I.D. 105 mm O.D. 115 mm	

5.3 Adhesives

Adhesive dispersion KK 57v1 part no. 5 703 151 000





6. Exploded view

K1 alternator 0 120 400 ...

A21

Exploded view

Alternators 0 120 400..., 0 120 489..., 14V

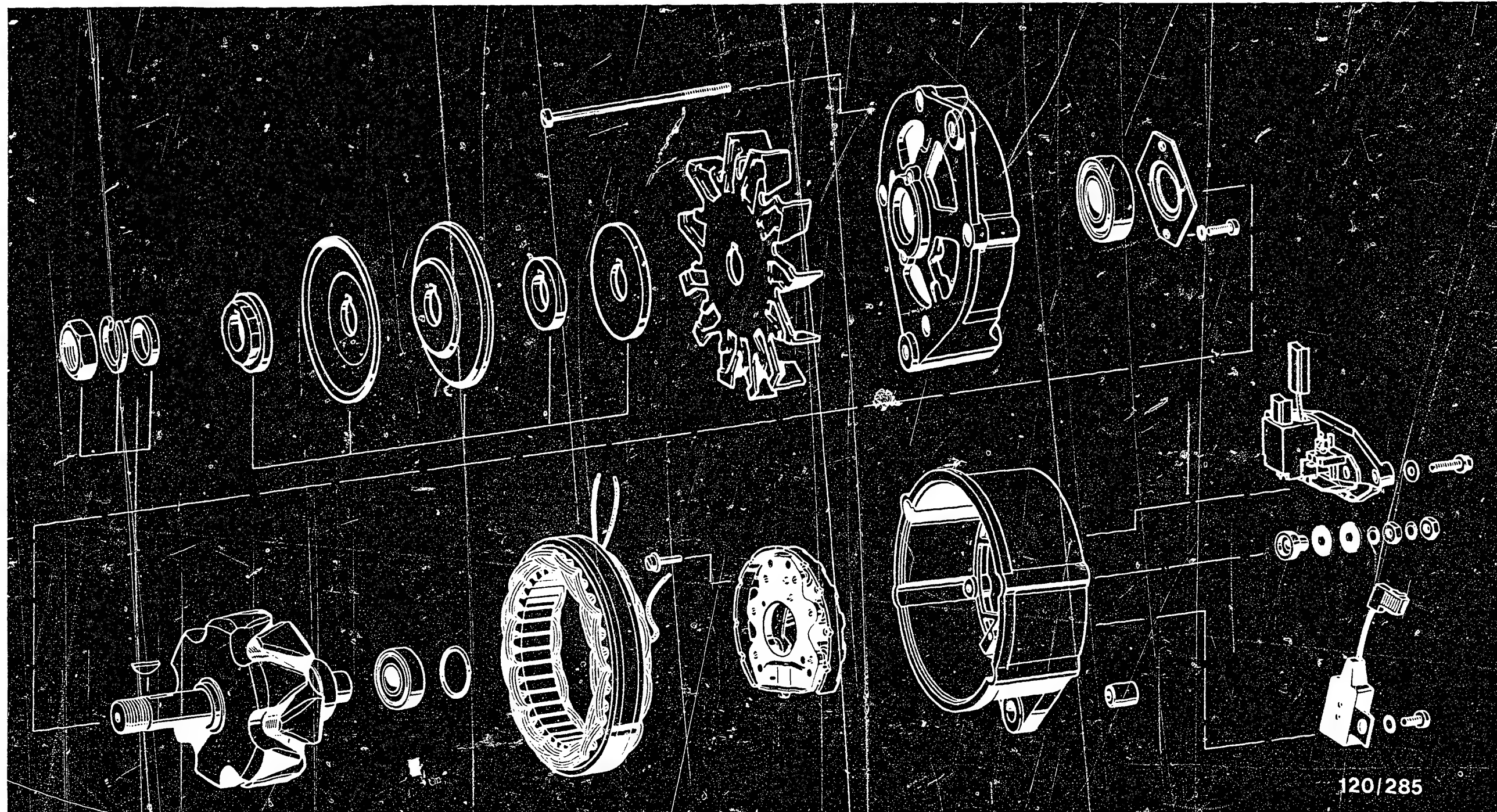


A22

Exploded view

Alternators 0 120 400..., 0 120 489..., 14V





6.1 Exploded view

0 120 489 ...

A23

Exploded view

Alternators 0 120 400..., 0 120 489..., 14V

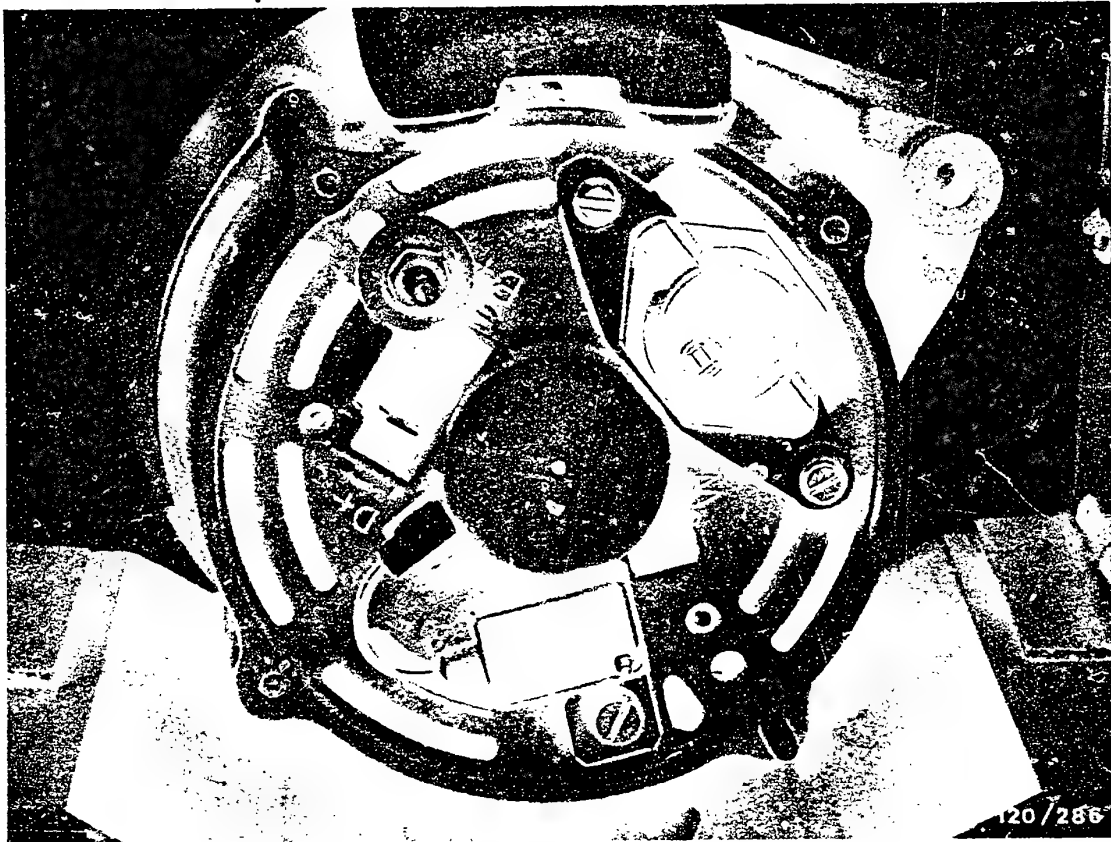


A24

Exploded view

Alternators 0 120 400..., 0 120 489..., 14V





7. Dismantling the alternator and testing the parts

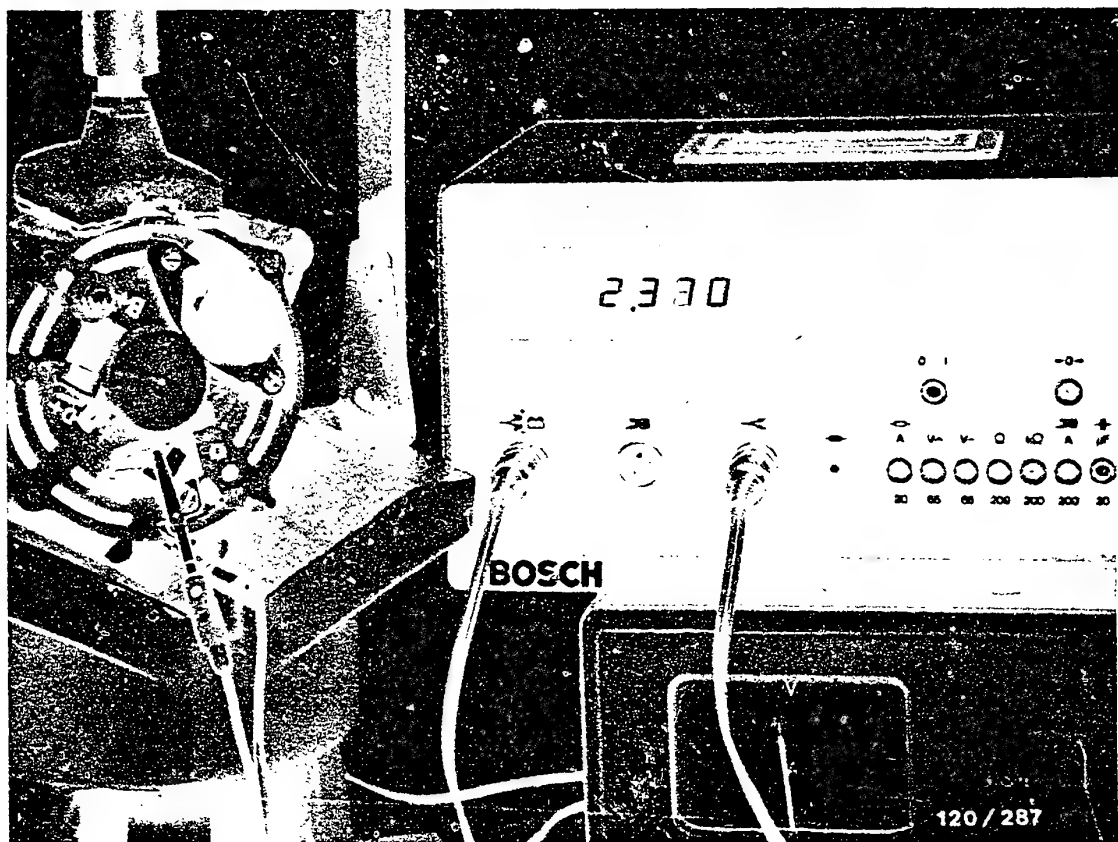
Clamp the alternator in clamping support KDAW 9999.

B1

Dismantling the alternator

Alternators 0 120 400..., 0 120 489..., 14V





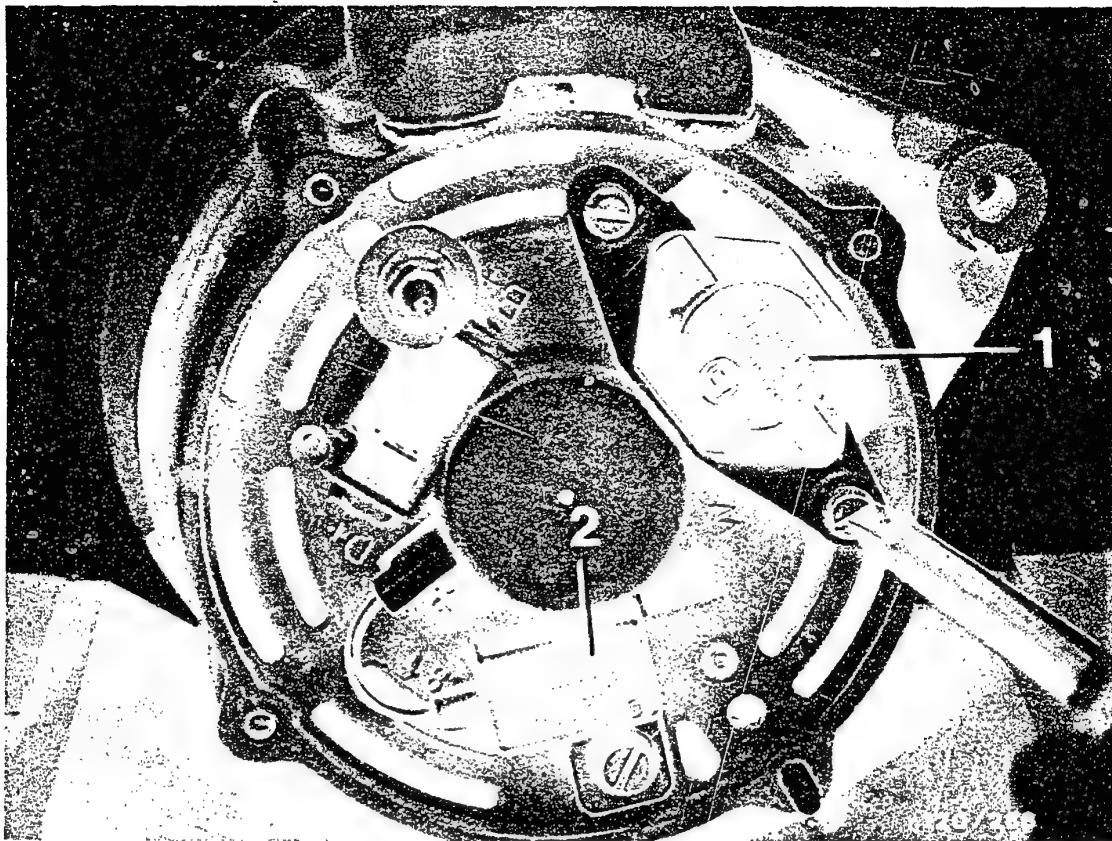
7.1 Testing the suppression capacitor

Remove lead of suppression capacitor from terminal B+. Connect electric tester between lead of suppression capacitor and terminal B- of alternator (picture).

Set value: 1.8 ... 2.6 μ F.

If this value is not reached, replace the defective suppression capacitor. After testing, discharge the suppression capacitor by short-circuiting so that there is no possibility of the cleaning liquid igniting when the parts are cleaned.





1 = Electronic regulator with carbon-brush holder
2 = Capacitor

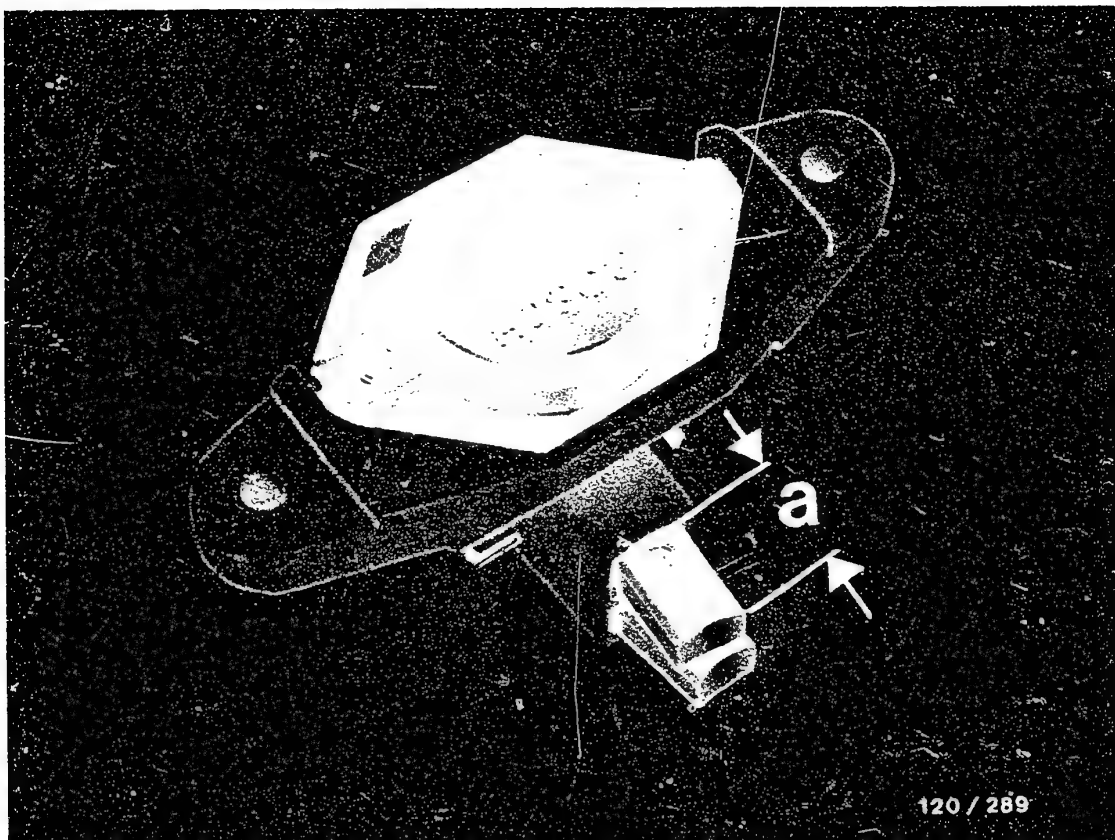
Caution!

Before further dismantling the alternator, first of all remove the electronic regulator.

To do this, unscrew the 2 fastening screws on the regulator.

If this sequence of operations is not followed, the carbon brushes will break when the alternator is taken apart.





7.2 Testing the regulator for external damage and replacing the carbon brushes

If the carbon brushes are broken off or if the projection dimension "a" is less than 7 mm, replace the carbon brushes.

Observe dimension "a" when soldering in the new carbon brushes.

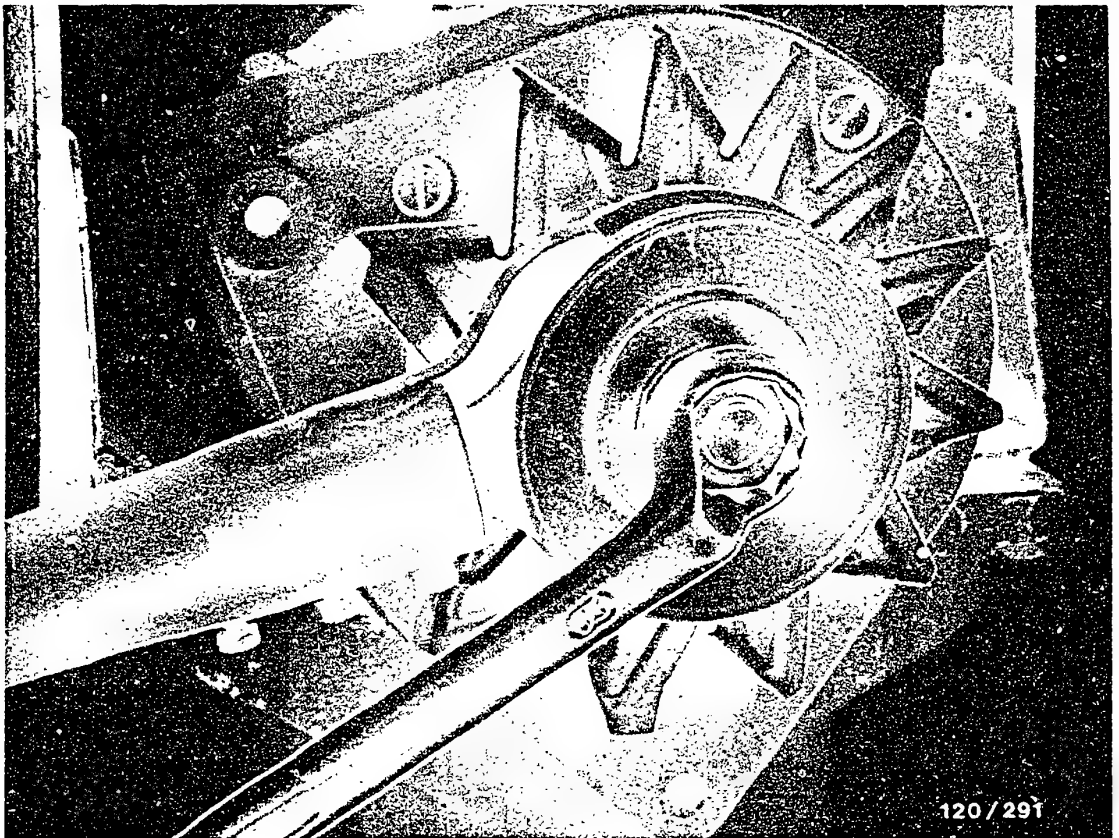


Alternators	Collector ring dia. (mm)	Brush projection (mm)	
		New	Min.
With EE regulator 0 192 052 ..			
0 120 489 ..	27.8	14	5.0
0 120 489 ..	32.5	10	5.0
With EL regulator 1 197 311 0 ..			
0 120 489 ..	27.8	12...13	5.0
0 120 489 ..	32.5	11...12	5.0
With EM regulator 1 197 311 1 ..			
0 120 489 ..	27.8	12...13	5.0
With separately-mounted regulator 0 192 ..			
0 120 400 ..	27.8	14	5.0
	32.5	10	5.0
0 120 400 836	27.8	10	5.0

Note:

Solder (colophonium tin only) must not flow into copper strand. Silicon tubing over copper strand must be clamped next to the solder joint.
After installing, check carbon brushes for freedom of movement.





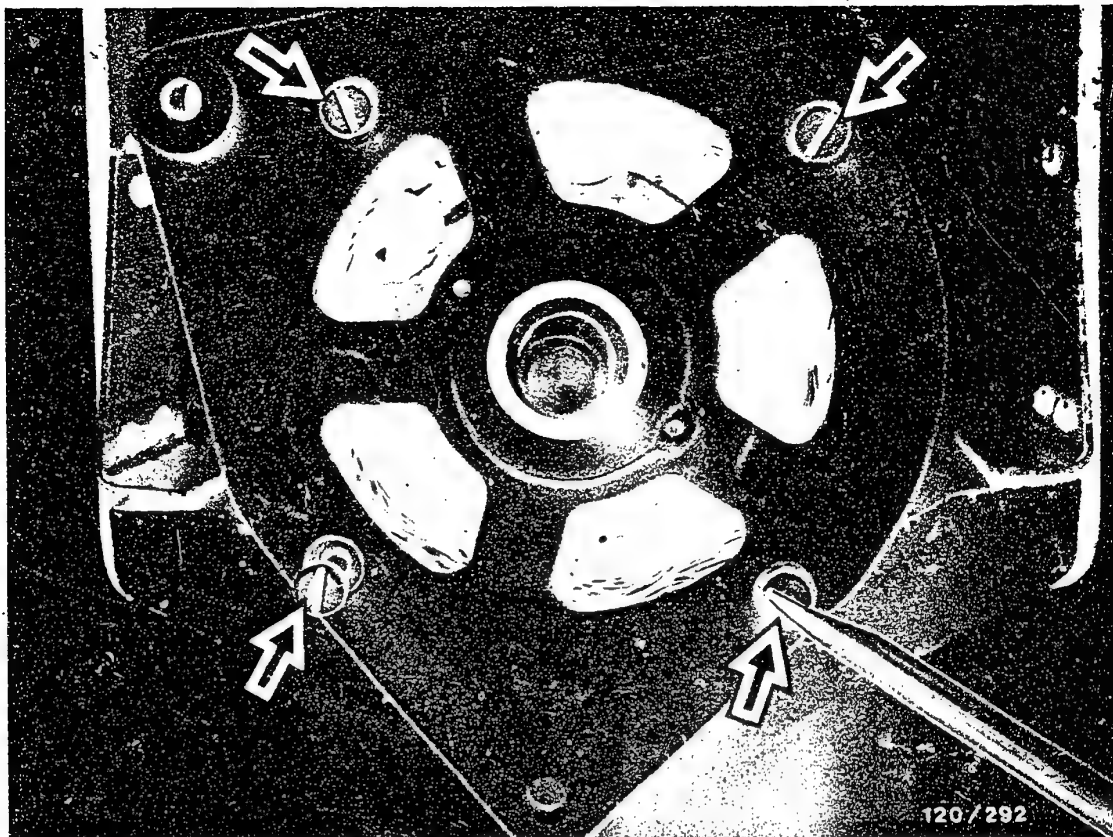
Using holding tool KDLI 6006 and 22 mm open-end wrench, loosen fastening nut and remove pulley with fan.

B6

Dismantling the alternator

Alternators 0 120 400..., 0 120 489..., 14V

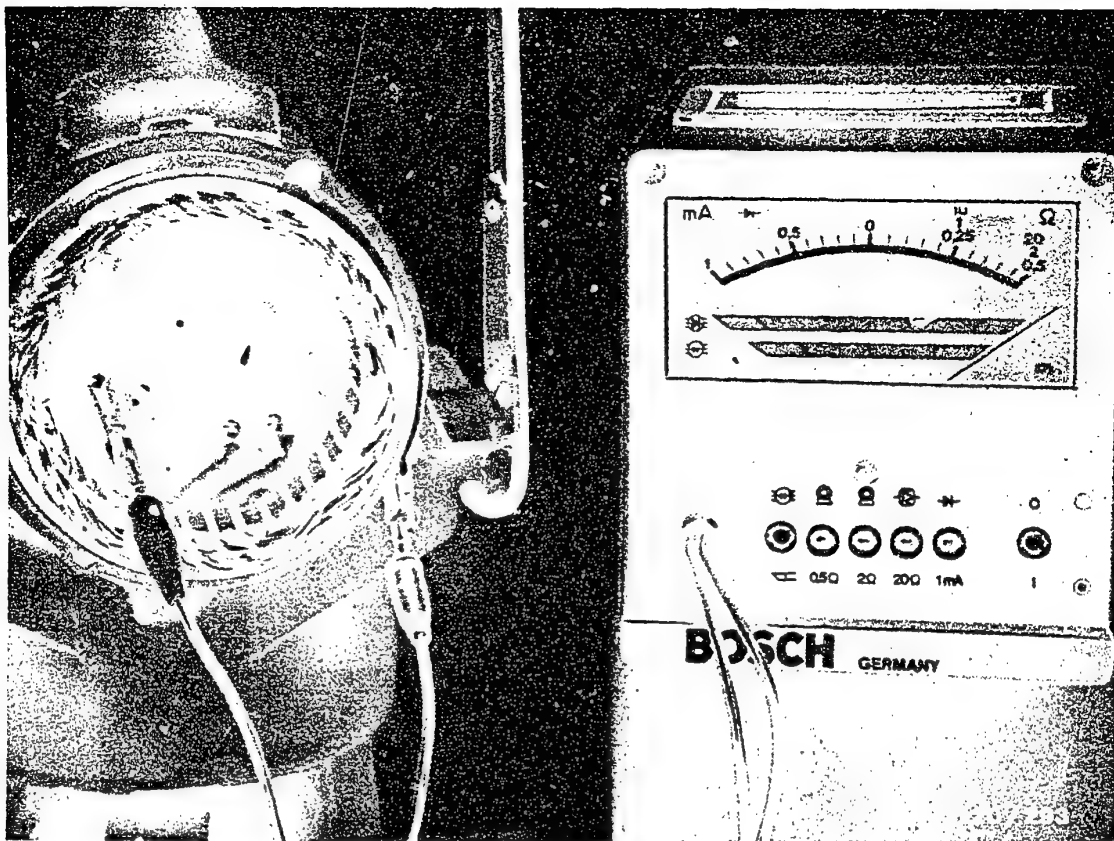




Caution

Before the alternator is further dismantled, mark the drive end shield, collector-ring end shield and stator so that these parts are brought into the same position again when assembling.

Loosen four fillister-head screws (arrows) and remove. Withdraw drive end shield with rotor from collector-ring end shield.



7.3 Testing the rectifier

Test the proper operation of the rectifier when connected up using EFAW 192 or WPG 012.00. Capacitor not connected. Note switch position on tester.

Test points:

Housing and winding ends

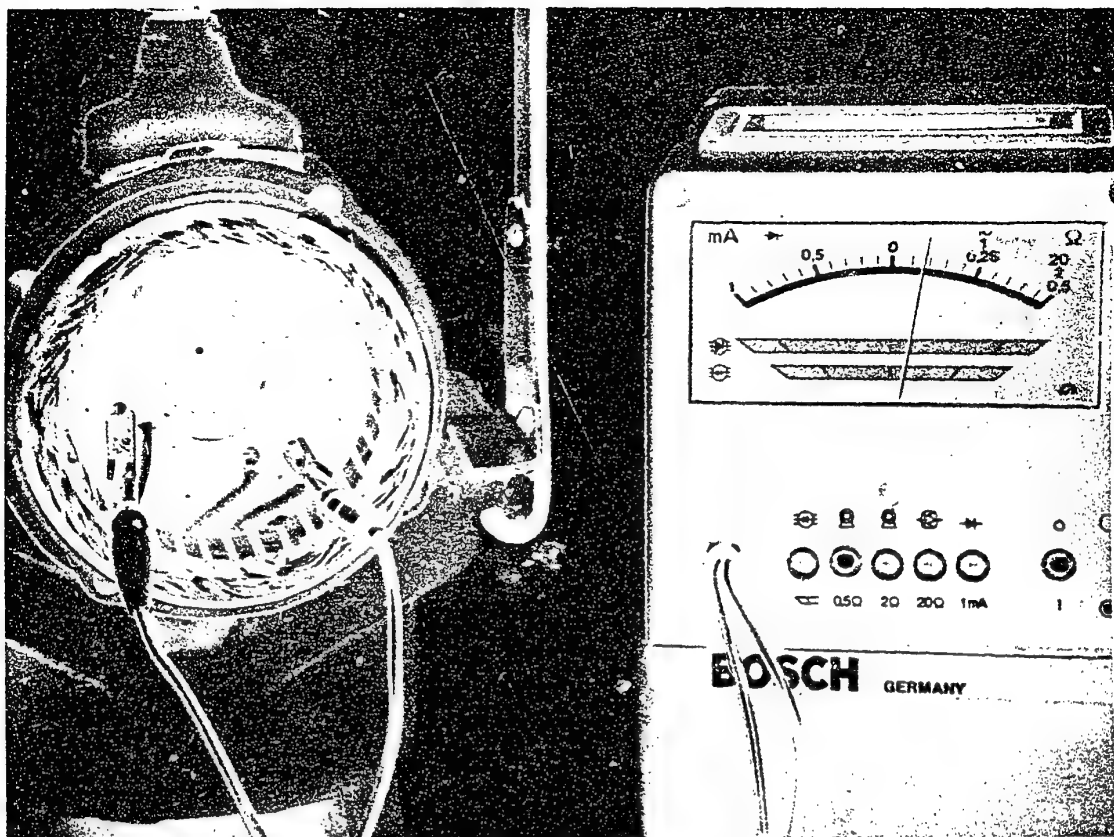
B+ and winding ends

D+ and winding ends

Rectifier is OK if the pointer of the tester is in the green area when testing.

If one or more diodes are defective, replace the complete rectifier.





7.4 Testing the stator (resistance)

Test the resistance of the stator while installed (see picture). Note switch position on tester.

Alternator	Resistance value Stator
0 120 4... ..	$\Omega + 10\%$
K1 (RL) 7V50A17	0.1
K1 (RL) 7V50A19	0.1
K1 (RL) 14V28A22	0.26

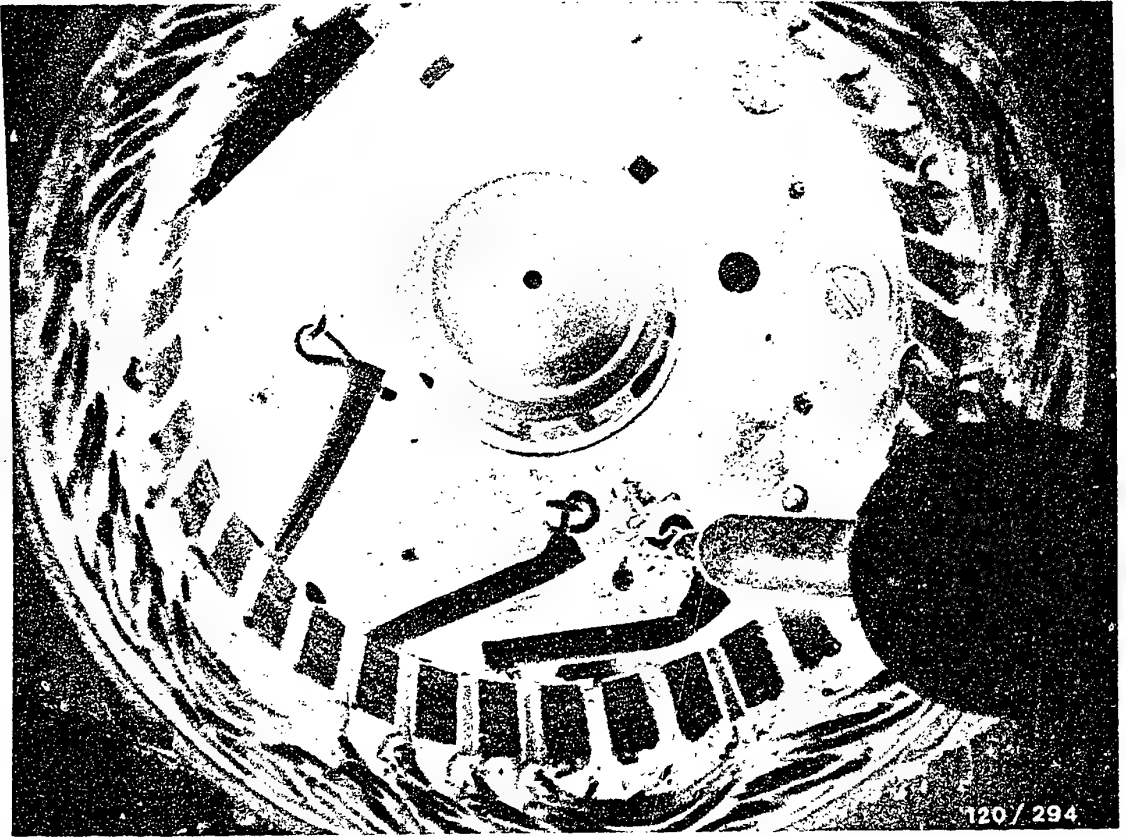


Type code	Resistance value
0 120 4.. ...	Stator $\Omega + 10\%$
K1 (RL) 14V32 A 22	0.1
35 A 20	0.26
35 A 21	0.26
35 A 22	0.2
43 A 21	0.18
45 A 20	0.18
45 A 22	0.17
45 A 24	0.15
50 A 21	0.11 - 0.14 ¹⁰⁾
50 A 22	0.13
55 A 20	0.14
65 A 21	0.1
65 A 24 ¹¹⁾	< 0.1
70 A 20	< 0.1

¹⁰⁾ No further tolerance given

¹¹⁾ Operate only with original fan

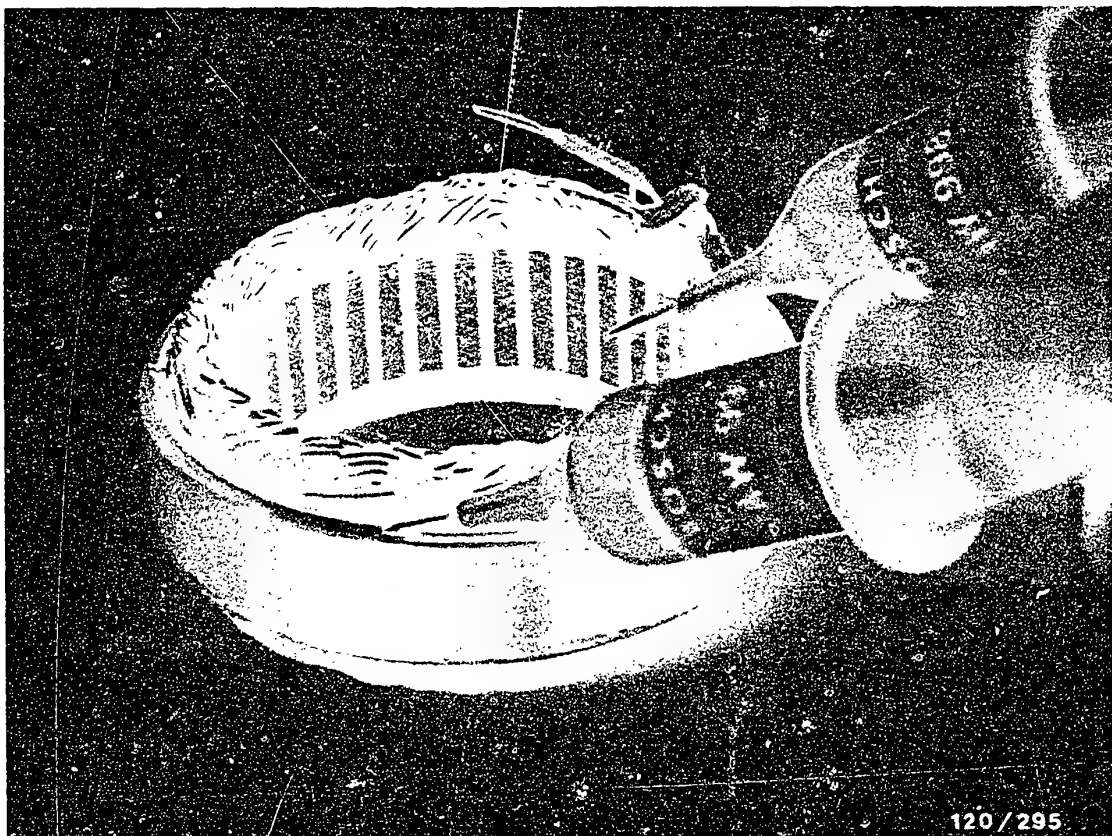




Removing the stator

Remove solder from the phase connections using soldering iron or soldering gun. Using a screwdriver, straighten the ends of the leads and pull the leads out of the fastening holes.

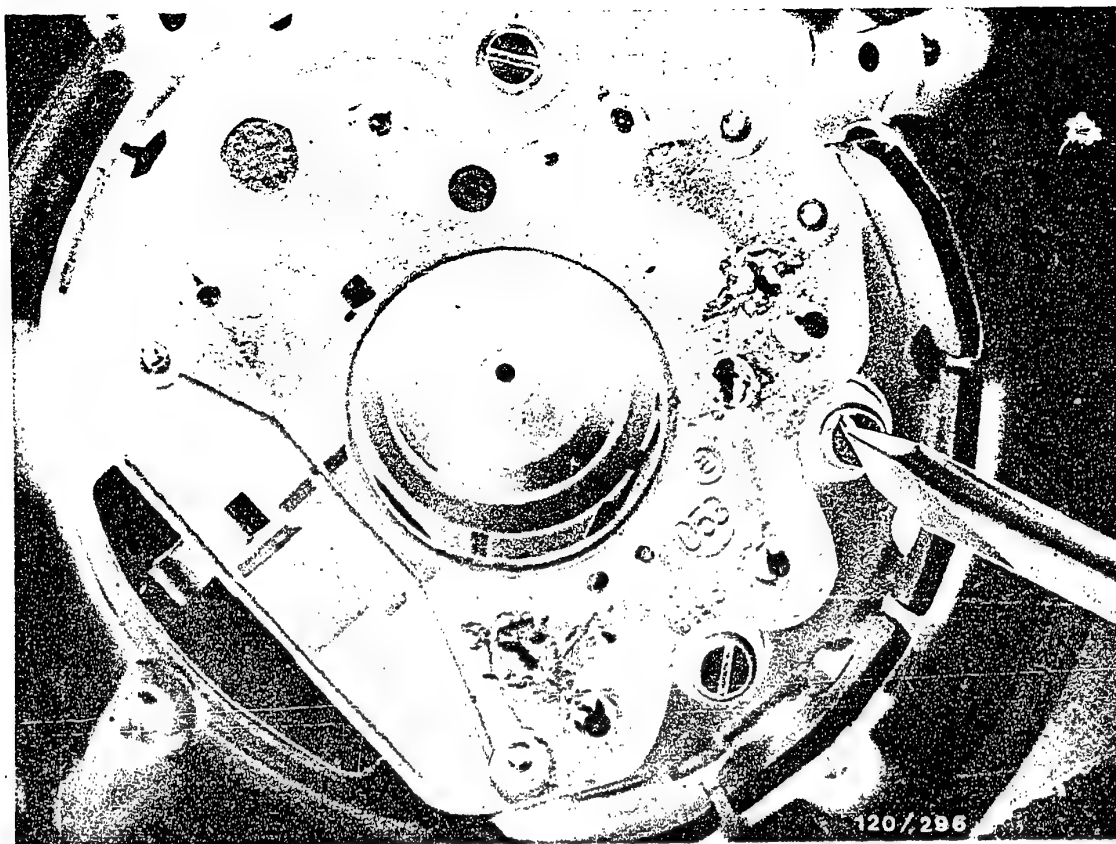




7.5 Testing the stator (short circuit to ground)

Test the stator for short circuit to ground using test prods EFAW 84 or KDAW 9983. (See picture).
Test voltage: 80 V a.c.





Removing the rectifier

Remove 3 washer-and-screw assemblies on inside of rectifier (picture).

Loosen terminal studs B+, B- and D+ on outside of collector-ring end shield. They are rigidly mounted on the rectifier.

If fitted also loosen terminal W.

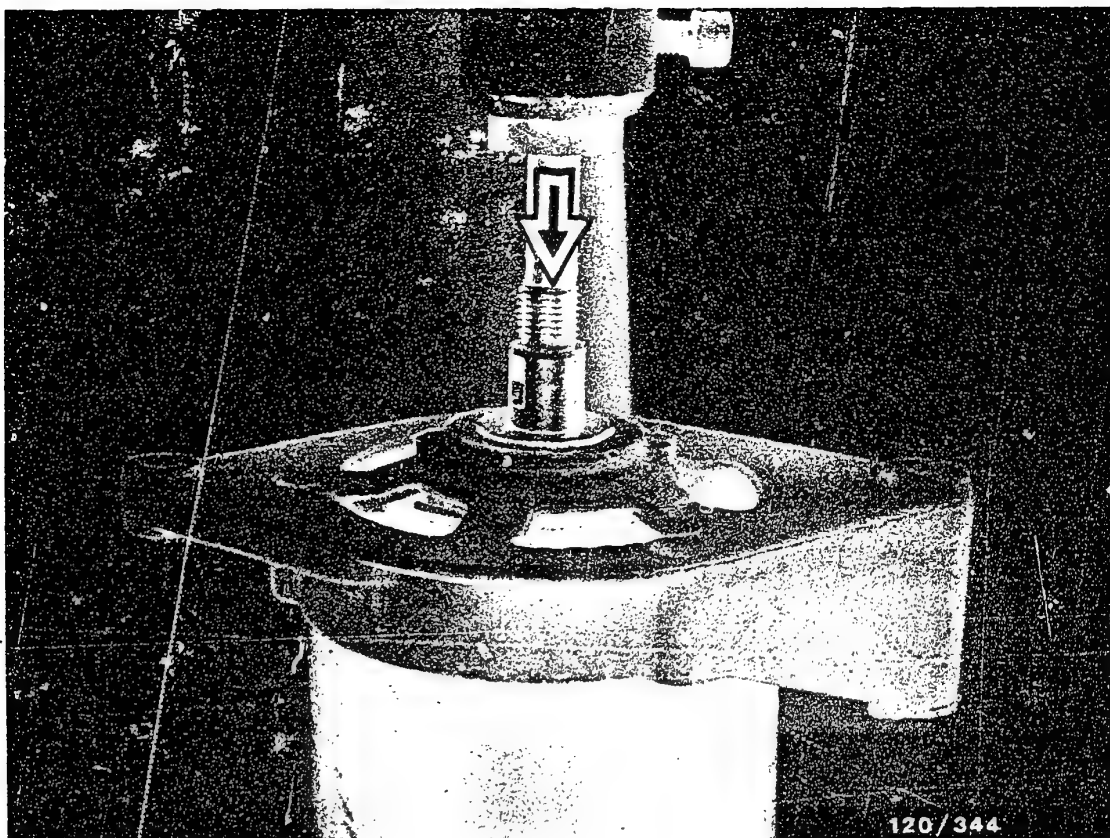
Withdraw rectifier from collector-ring end shield.

B 13

Dismantling the alternator

Alternators 0 120 400..., 0 120 489..., 14V



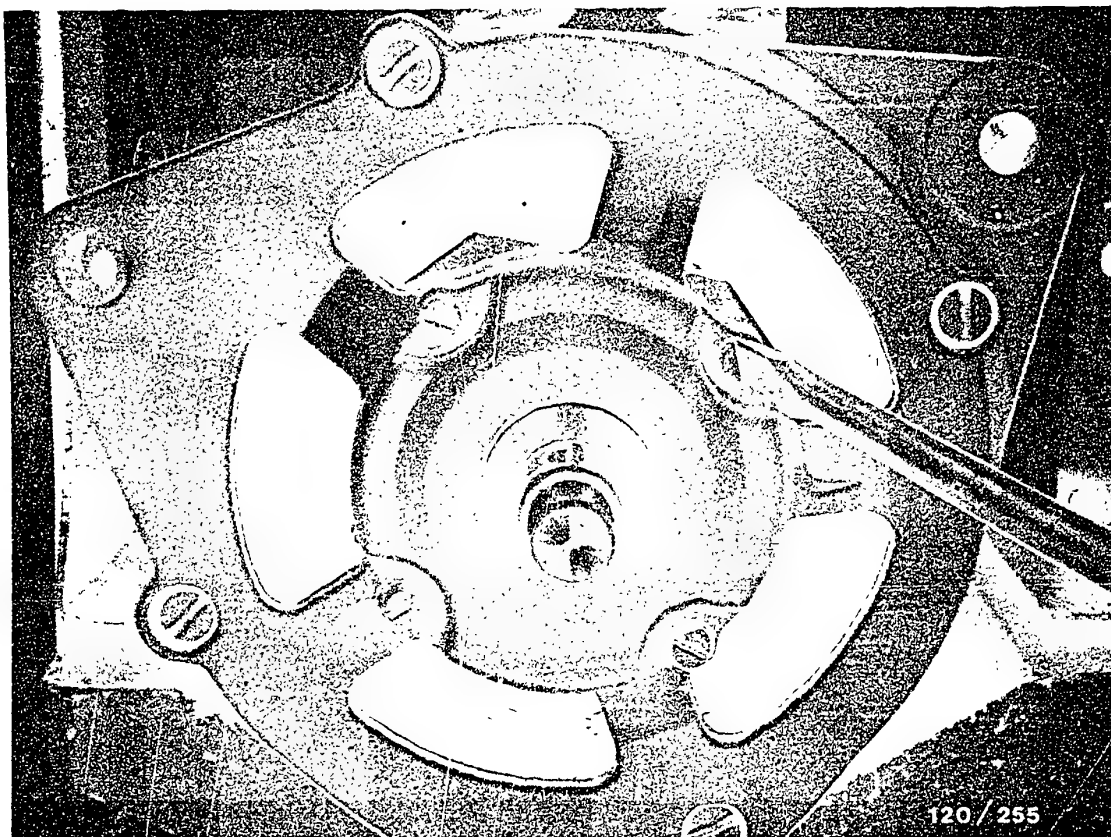


Removing the claw-pole rotor

The claw-pole rotor need only be removed if collector rings, or excitation winding or deep-groove ball bearing or collector-ring end shield are defective.

If the holding plate of the deep-groove ball bearing is screwed from inside the alternator, press out the claw-pole rotor under an arbor press. To do this, use an old stator frame (e.g. starting motor) with 105 mm I.D. and 115 mm O.D. (see picture).





Removing the claw-pole rotor

The claw-pole rotor need only be removed if collector rings, excitation winding or deep-groove ball bearing or collector-ring end shield are defective.

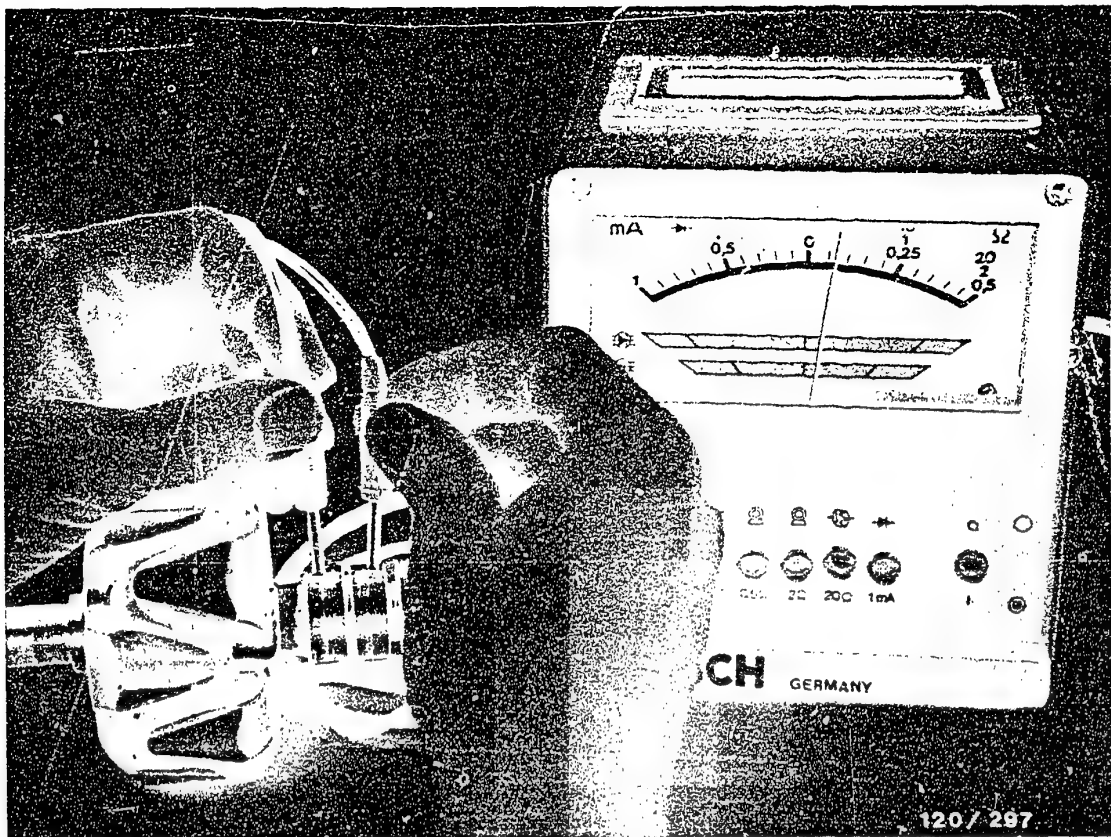
If the holding plate of the deep-groove ball bearing is screwed from outside, then clamp the claw-pole rotor in the clamping support.

Loosen 4 fastening screws and remove (see picture).

Pull deep-groove ball bearing with rotor out of end shield (sliding fit).

Remove deep-groove ball bearing with cover plate using commercially available puller.





7.6 Testing the rotor resistance

Measure the rotor resistance using alternator tester WPG 012.00 or electric tester ETE 014.00 (see picture).

Alternator	Resistance value
0 120 4... ..	Rotor $\Omega + 10\%$
K1 (RL) 7 V 50 A 17	1.0
7 V 50 A 19	1.0



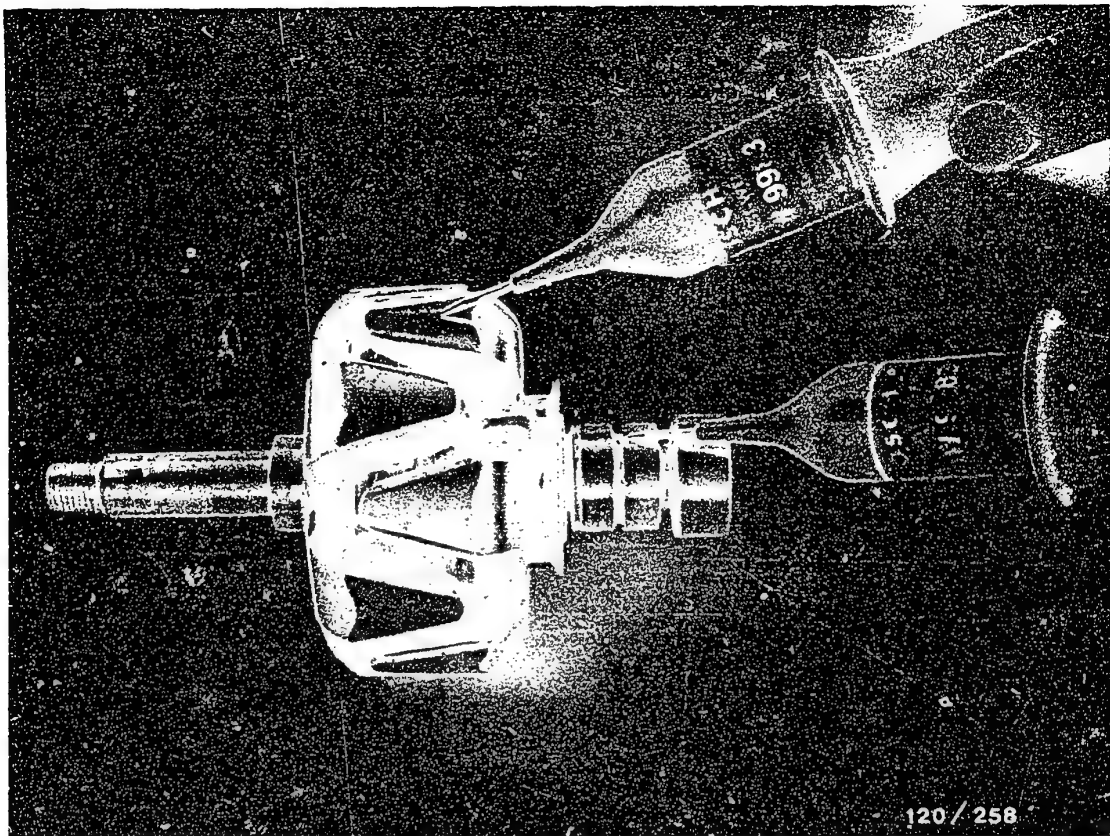
Testing the rotor resistance (continued)

Alternator 0 120 4.. K1 (RL) 14V..	Resistance value Rotor Ω + 10%
28 A 22	4.0 5)
32 A 22	7.0
35 A 20	4.0 5)
35 A 21	5.2
35 A 22	4.0 5)
43 A 21	4.0 5)
45 A 20	4.0 5)
45 A 22	4.0 5)
45 A 24	4.0 5)
50 A 21	4.4 4.9 10)
50 A 22	4.0 5)
55 A 20	4.0 5)
55 A 22	4.0 5)
65 A 21	2.8
65 A 24	3.4
70 A 20	2.8

5) For alternators with transistor regulator 3.4 or 2.9 Ω applies

10) No further tolerance given

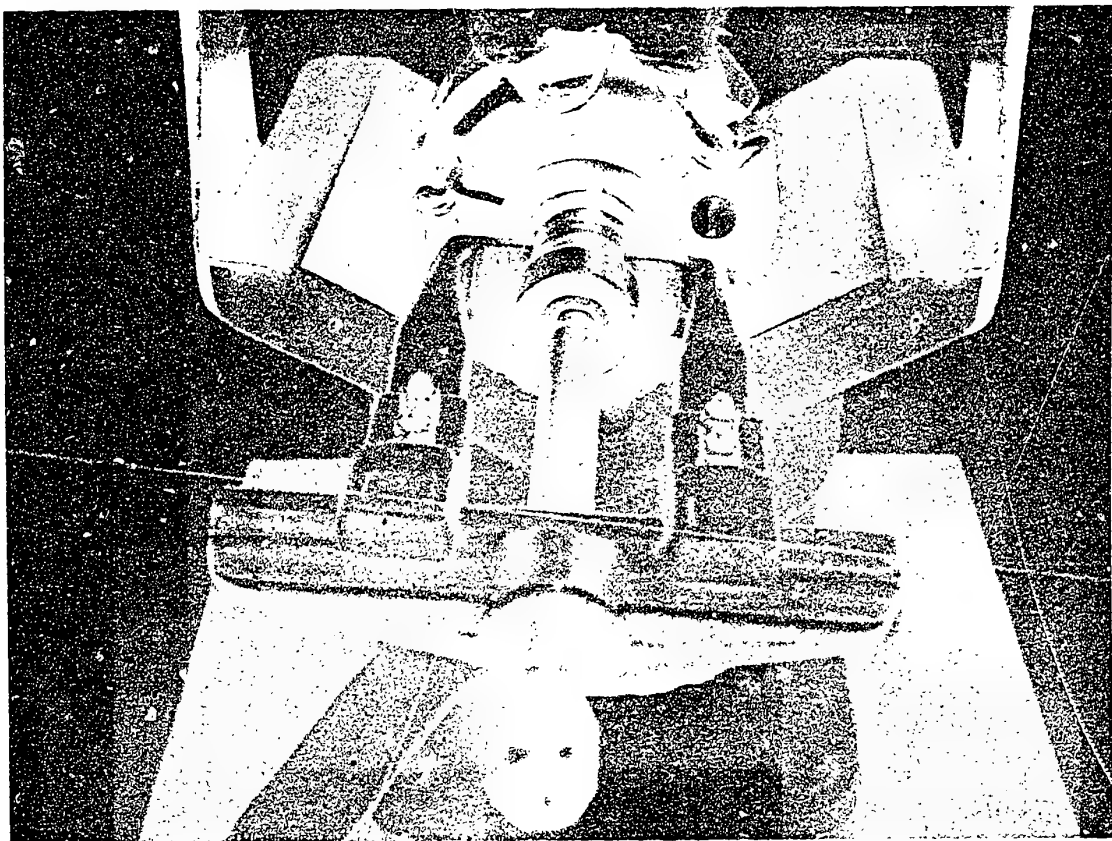




7.7 Testing the rotor for short circuit to ground

Test the rotor for a short circuit to ground using test prods EFAW 84 or KDAW 9983.
Test voltage 80 V AC.

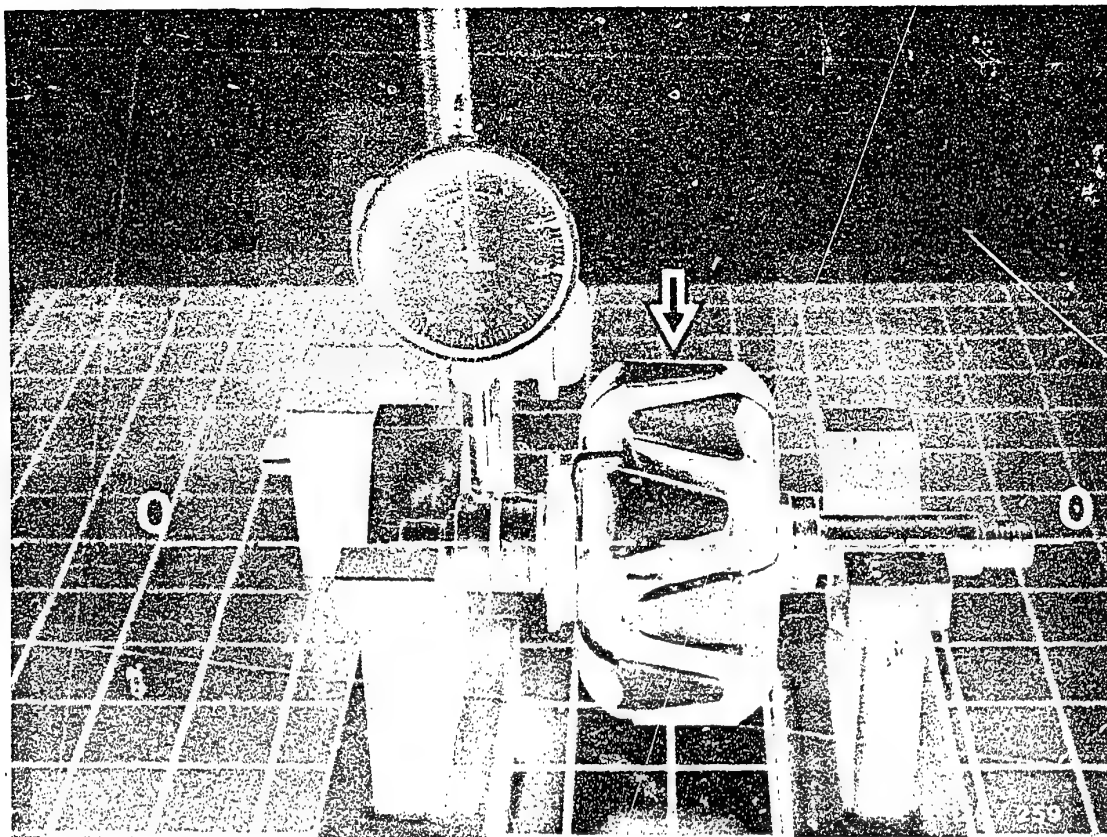




Removing the deep-groove ball bearing on the collector-ring end

Remove the deep-groove ball bearing using a commercially available puller (see picture).





7.8 True-running test

Mount the journals of the rotor in the V-supports and align exactly horizontal. Carry out true-running test on outside diameter of rotor (see picture) and on outside diameter of the collector rings (arrows) using magnetic instrument stand T-M1 (4 851 601 124) and dial indicator EFAW 7.

Maximum error on rotor 0.5 mm.

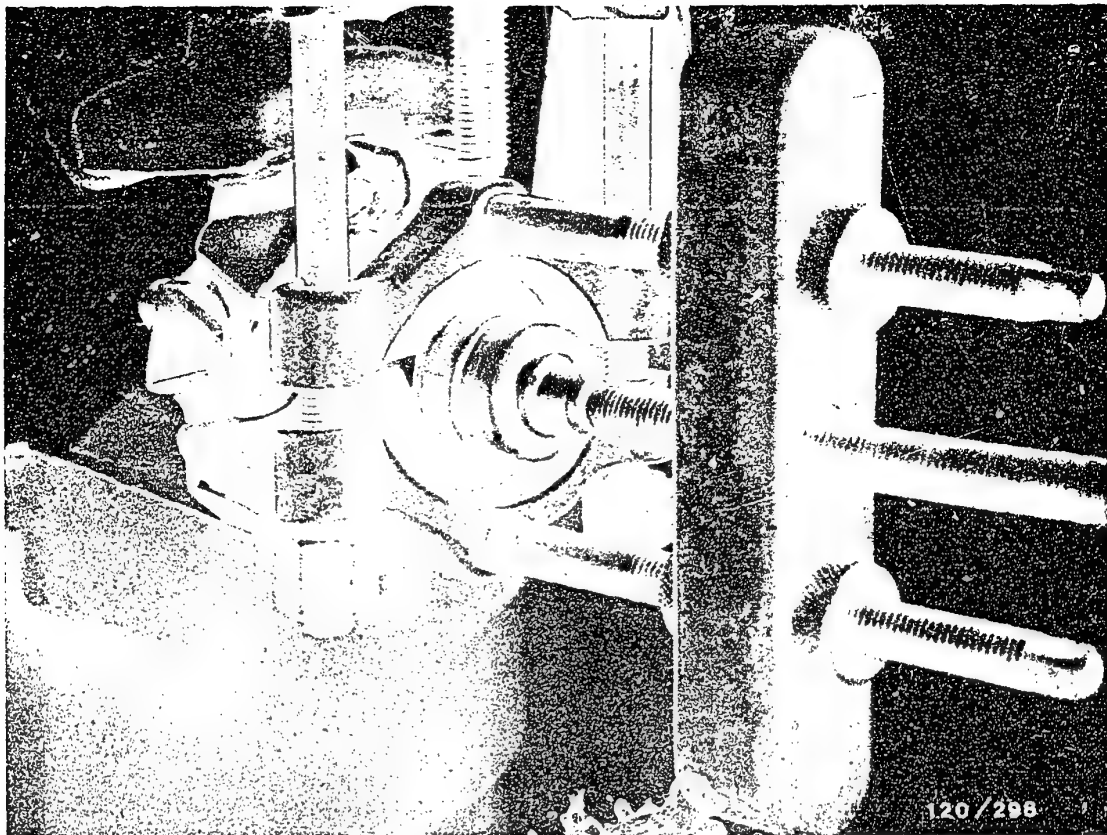
Maximum error on collector rings 0.03 mm.

If error is greater, skim collector rings.

Minimum diameter of collector rings:

Alternator	Collector ring dia. (mm)	
	new	min. dia.
0 120 400..., .. 836	27.8	26.8
0 120 400..	32.5	31.5
0 120 489..	27.8	26.8
0 120 489..	32.5	31.5





Removing the collector rings

Unsolder leads of excitation winding from the collector rings.

Using commercially available puller, remove the collector rings from the rotor shaft (not shown).



8. Cleaning the parts

C A U T I O N ! F I R E H A Z A R D !

Alternators are being increasingly fitted with long-storage capacitors (e.g. for the interference suppression of receivers and transmitters).

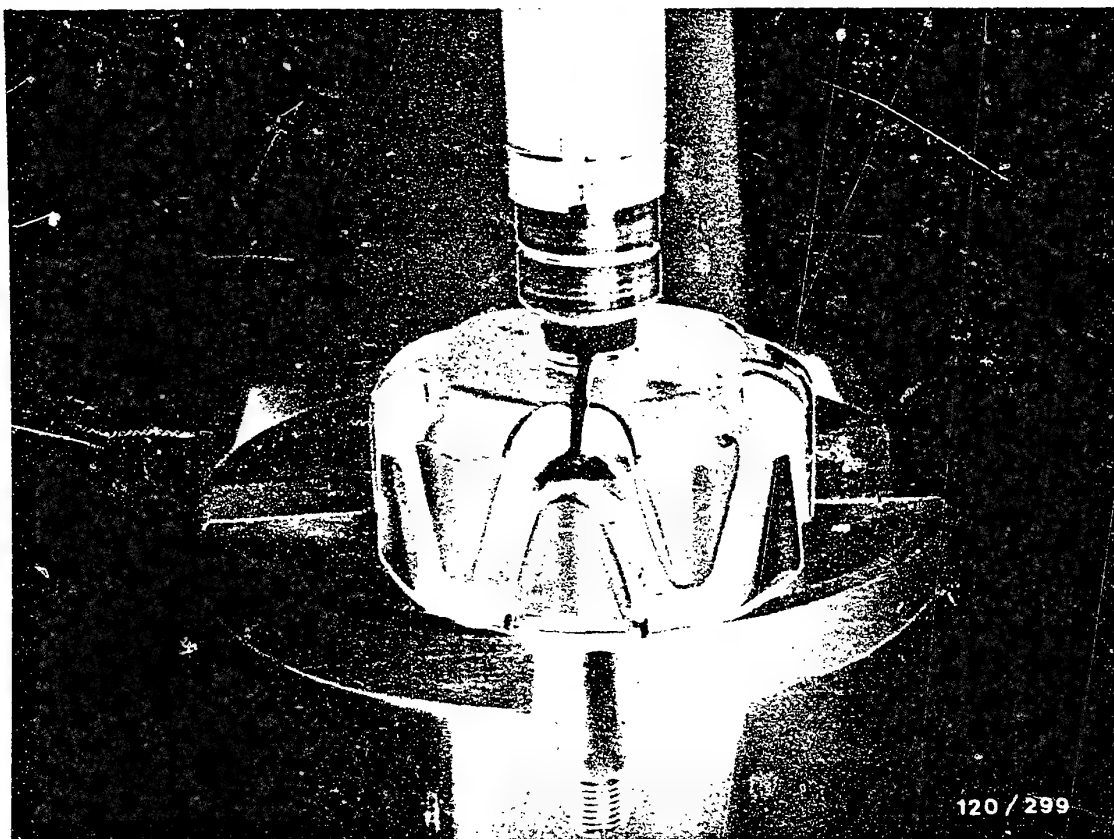
When washing parts of the alternator it is possible for the capacitor to discharge when immersed in cleaning fluids, there then being the danger that inflammable liquids will ignite. For this reason, parts with capacitors must only be washed in tri- or perchloroethylene.

C1

Cleaning the parts

Alternators 0 120 400..., 0 120 489..., 14V





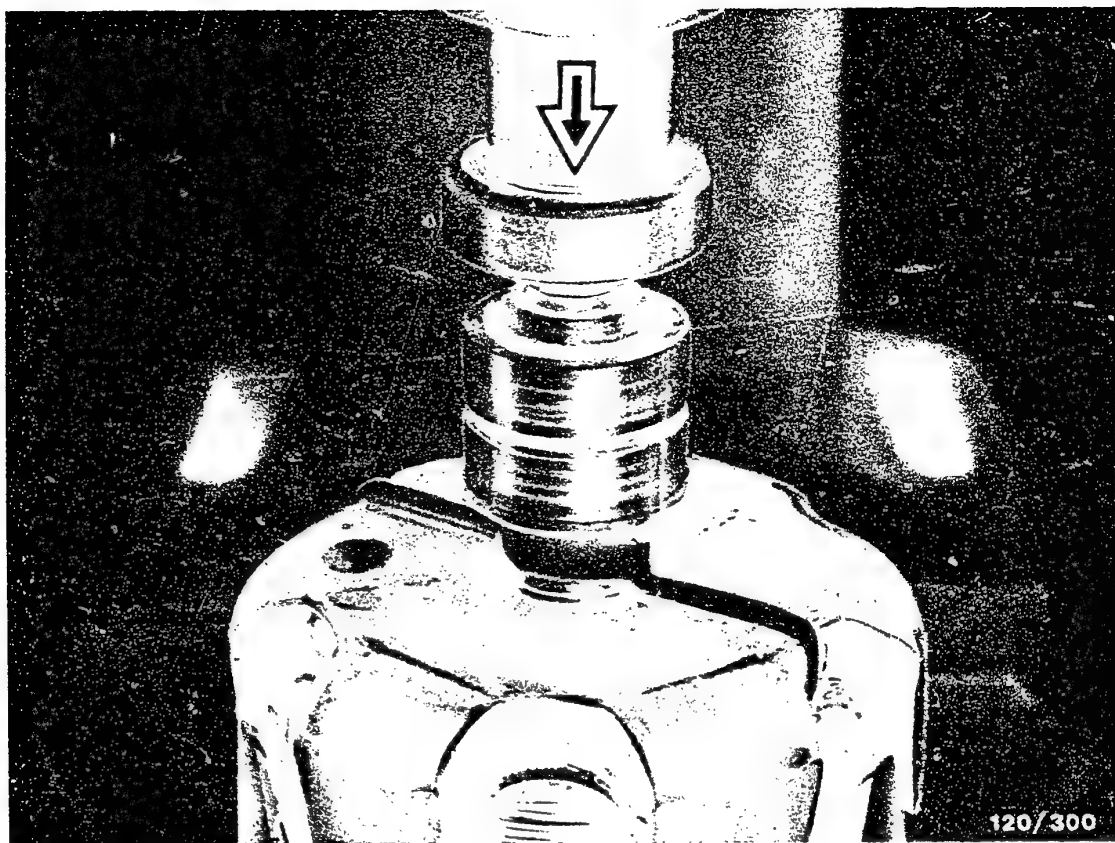
9. Assembling the alternator

Pressing on the collector rings

Place the collector rings on the rotor shaft. Introduce one lead from the excitation winding into the groove in the collector rings. Then press on collector rings as far as they will go using press-on tool KDLJ 6004/1 and 6004/0/1. When doing this, position the groove of the press-on tool so that the lead of the excitation winding which is guided through the collector rings is visible.

Solder the wire leads of the excitation winding. Turn down the soldered joint on both collector rings until the collector rings are no longer uneven.





Pressing on the deep-groove ball bearing on the collector-ring end

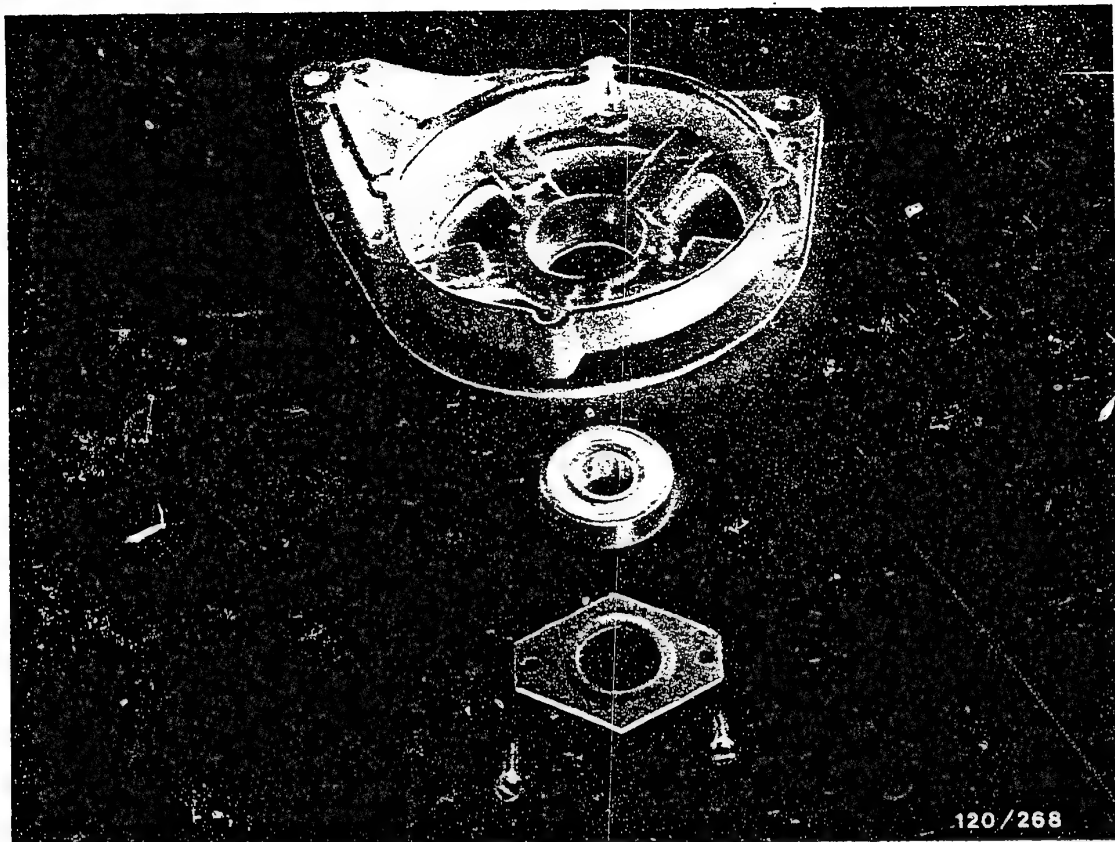
Place a new deep-groove ball bearing on the rotor shaft and press on as far as it will go under an arbor press using press-on tool KDLI 6499/0/3 (see picture).

C3

Assembling the alternator

Alternators 0 120 400..., 0 120 489..., 14V





Assembling the drive-end-bearing housing if holding plate is screwed on from inside alternator:

Place a new deep-groove ball bearing in the drive-end-bearing housing.

Fasten new holding plate with 2 fillister-head screws (see picture).

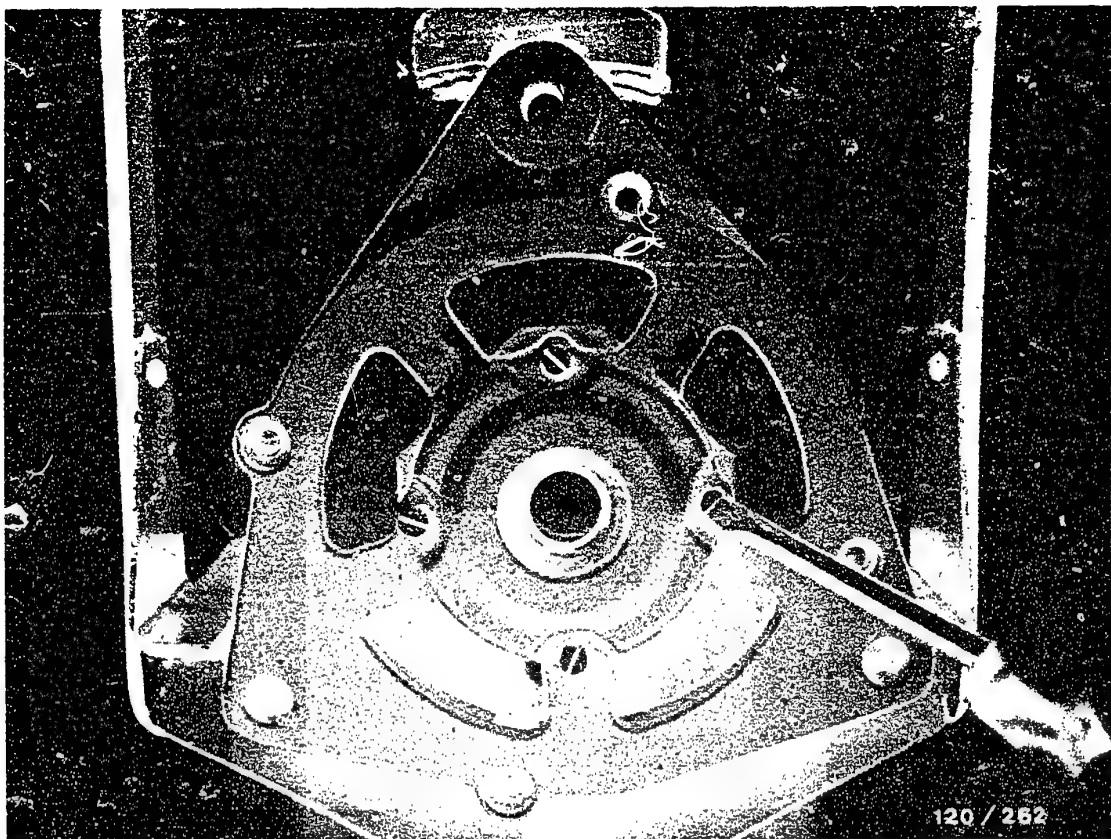
Tightening torque for both screws: 2.4...3.5 Nm.

C4

Assembling the alternator

Alternators 0 120 400... 0 120 489... 14V



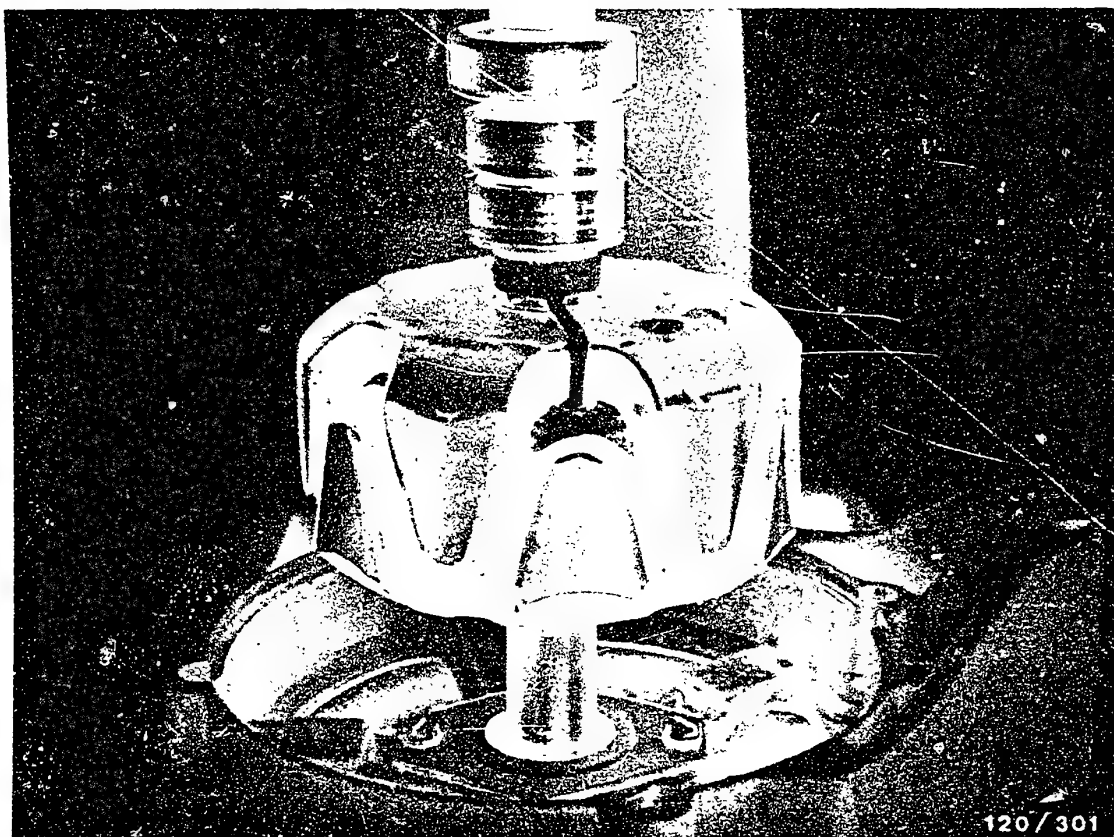


Assembling the drive-end-bearing housing if holding plate is screwed from outside:

Introduce a new deep-groove ball bearing into the drive-end-bearing housing.

Position new holding plate and fasten with 4 screws (see picture), tightening cross-wise to a tightening torque of 2.4...2.9 Nm.





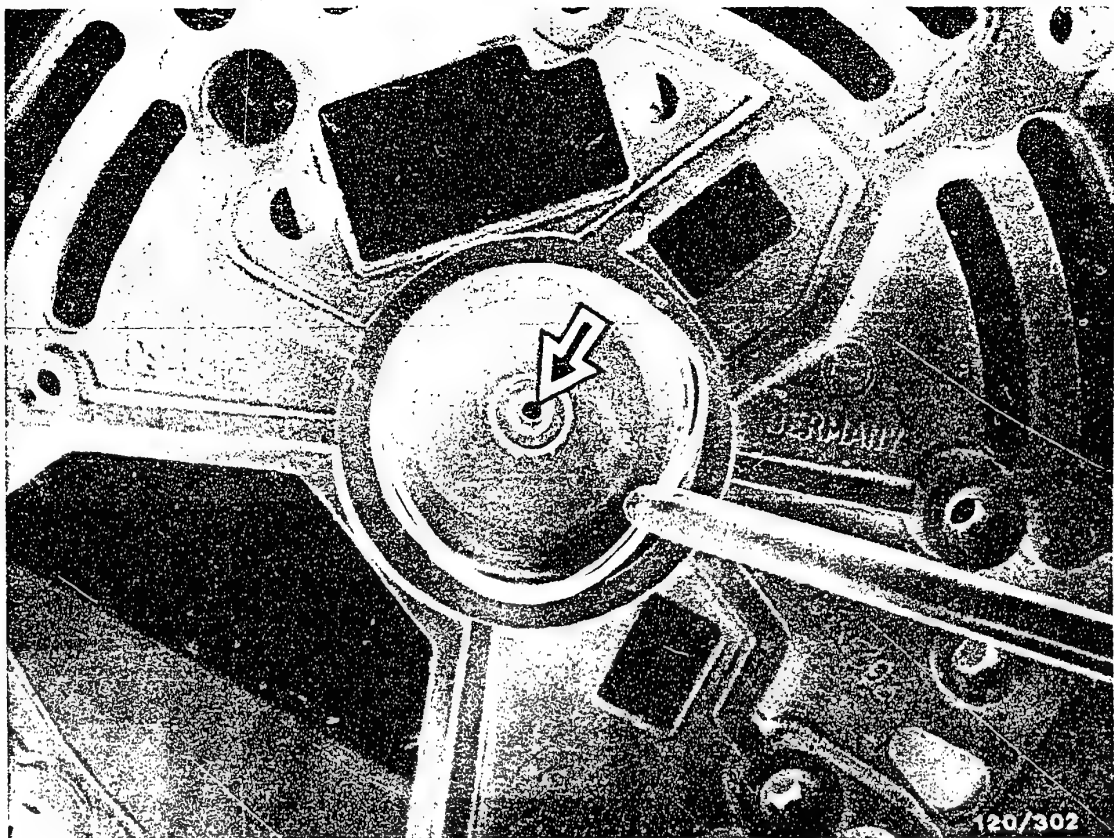
Pressing the rotor into the drive-end-bearing housing

Place spacer ring right side up on a suitable surface so that it is fully supported. Place the drive-end-bearing housing over the spacer ring with its outside pointing downwards.

Introduce the rotor into the drive-end-bearing housing (see picture).

Clamp press-on tool KDLI 6002 into the arbor press and press the rotor into the drive-end-bearing housing as far as it will go.

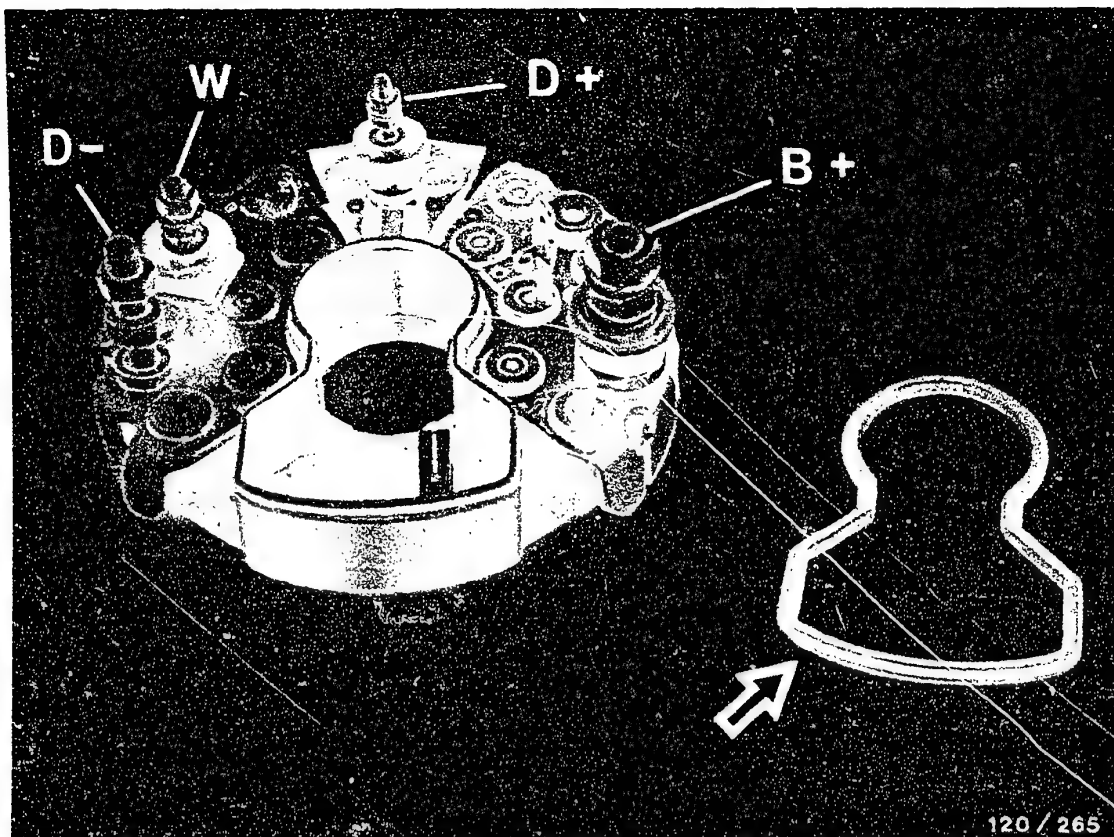




Replacing the O-ring in the collector-ring end shield

Check the O-ring for damage and replace if necessary.
Hole in end shield (arrow) must be kept clear.
Also on the outside, do not cover with adhesive label
etc.





120 / 265

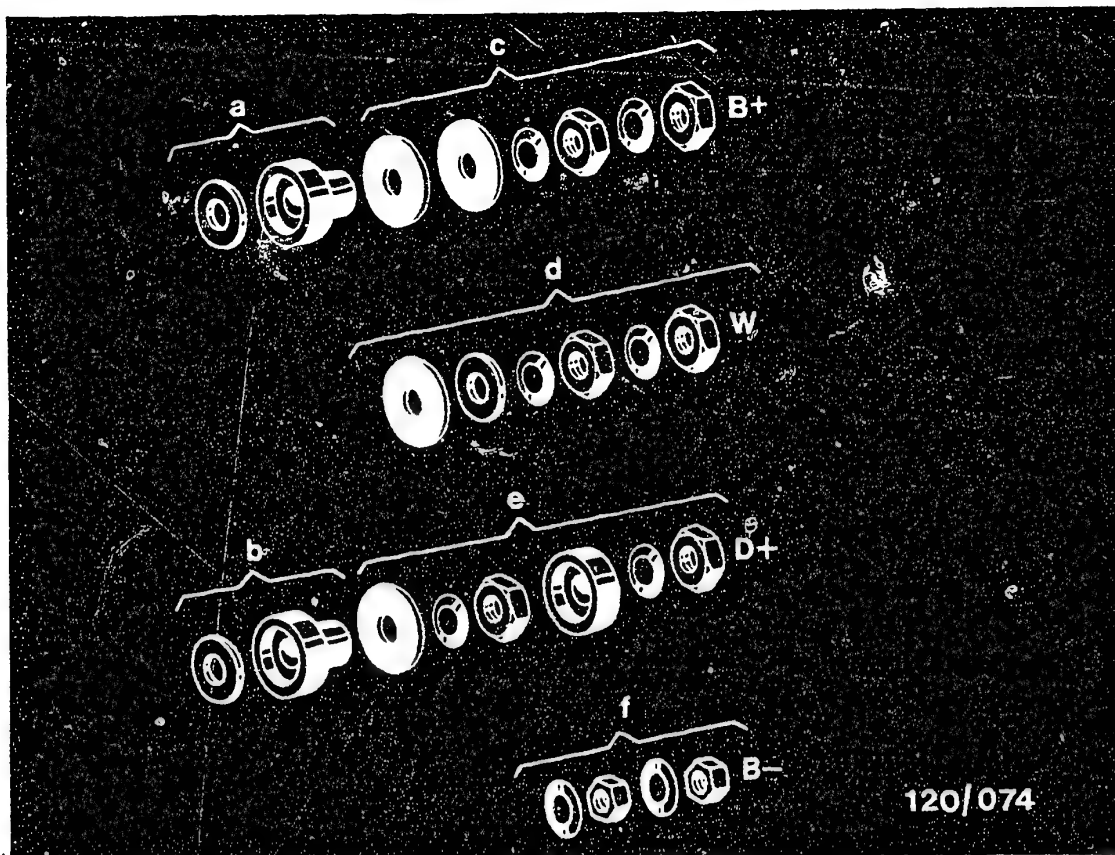
Installing the rectifier

Place gasket (arrow) on keyhole of rectifier and glue on all round with adhesive dispersion 5 703 151 000.

Place plain washer and insulating bushing over B+ and D+ terminals.

Introduce the rectifier into the collector-ring end shield.





Fasten the rectifier at the terminal end using parts c, d, e, f (if available).

Tightening torques:

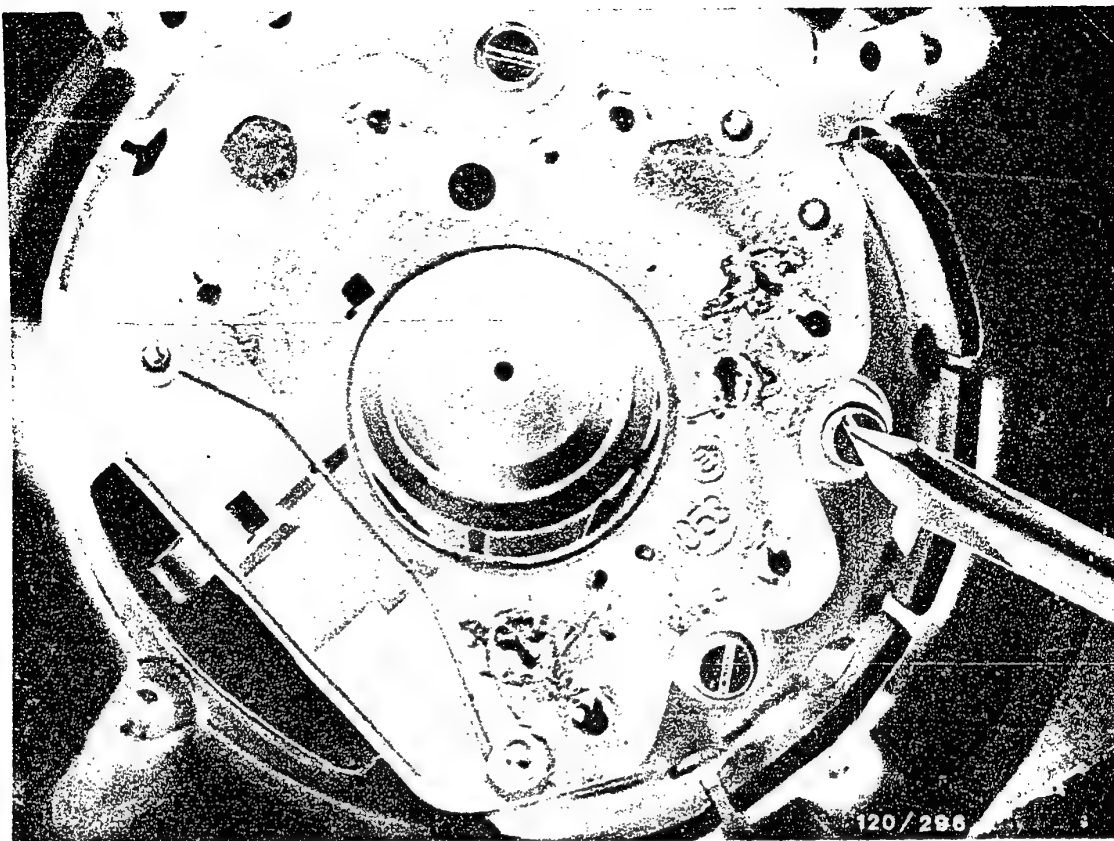
Part c = 4.8 ...6.8 Nm

Part d = 4.8 ...6.8 Nm (if available)

Part e = 1.6 ...2.3 Nm

Part f = 1.6 ...2.3 Nm (if available)





Screw down the rectifier on the alternator side with 3 washer-and-screw assemblies - depending on the version of alternator.

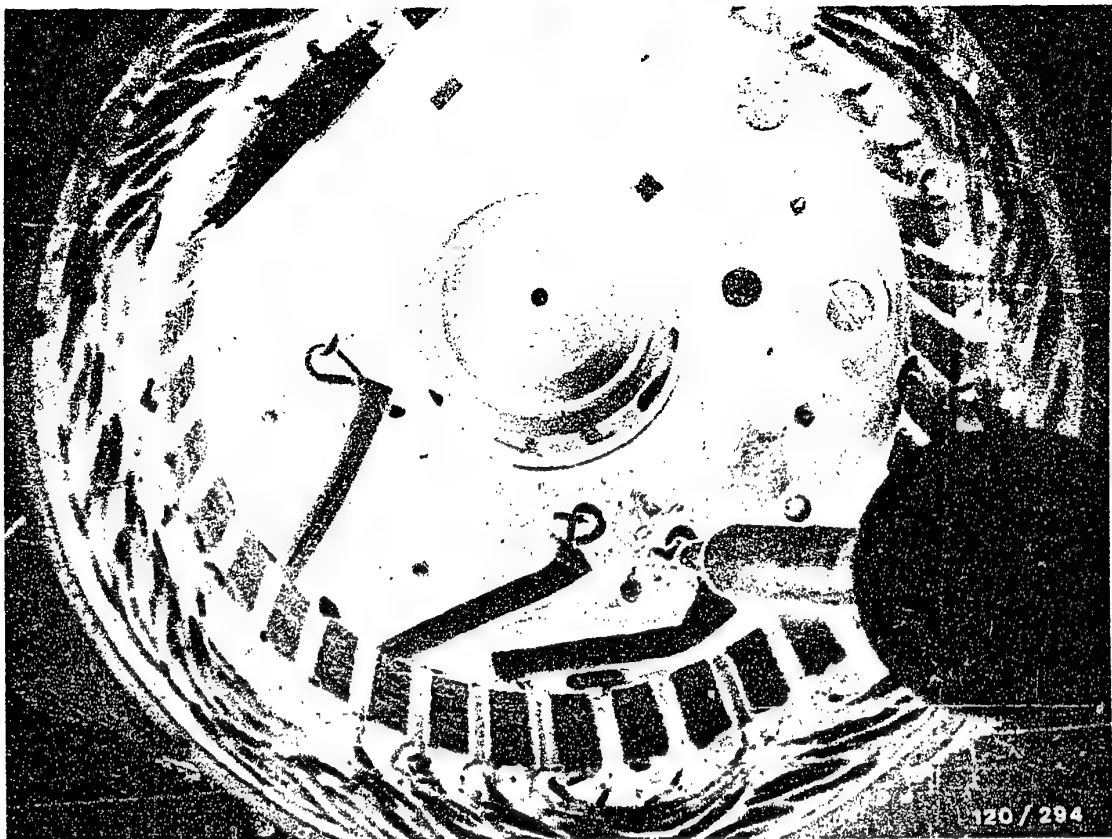
Tightening torque: 1.4 ... 2.0 Nm

C 10

Assembling the alternator

Alternators 0 120 400..., 0 120 489..., 14V





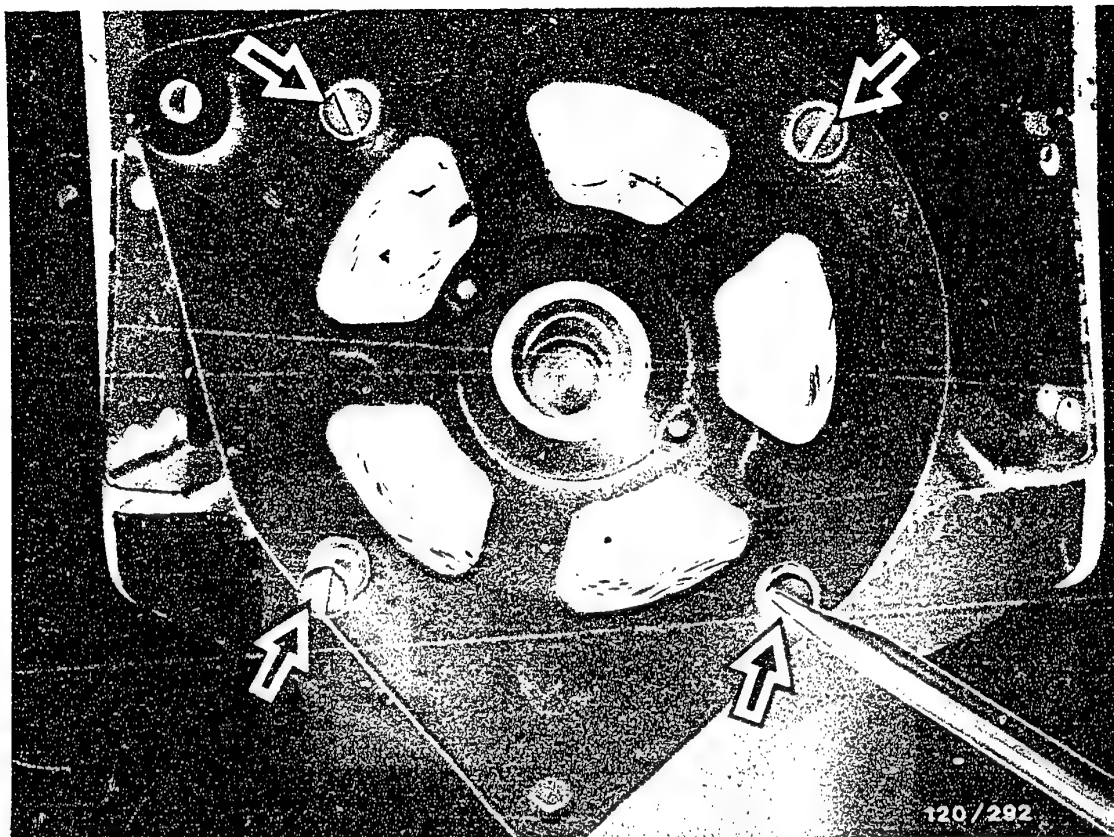
Fitting the stator and the rotor

Place the stator against the rectifier bearing. Bring the markings on the collector-ring end shield and stator (made before dismantling the alternator) into alignment.

Solder on the connection wires of the stator (see picture). When doing this, make sure that the connection wires will not afterwards touch against the rotor. Carefully introduce rotor with drive end shield so that the roller bearing and the radial seal are not altered in their position.

Please note When soldering do not use too much solder, otherwise short-circuiting bridges may occur.



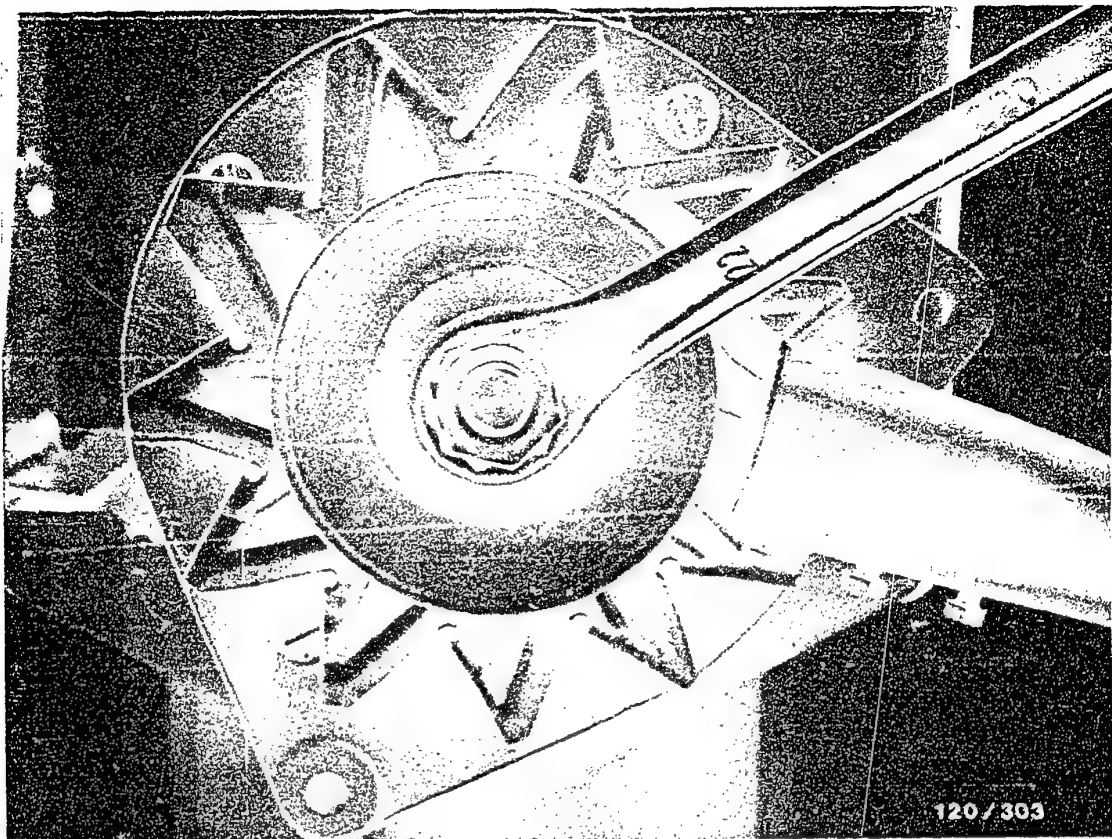


Screwing together the drive-end-bearing housing and the connector-ring end shield

To obtain correct true running of the rotor, the following operations are necessary:

Stick three feeler gauges between stator and rotor, thickness 0.2 mm.

Using a screwdriver, position 4 fastening screws (arrows), then tighten cross-wise to a tightening torque of 4.1 ... 5.5 Nm.



Mounting the fan

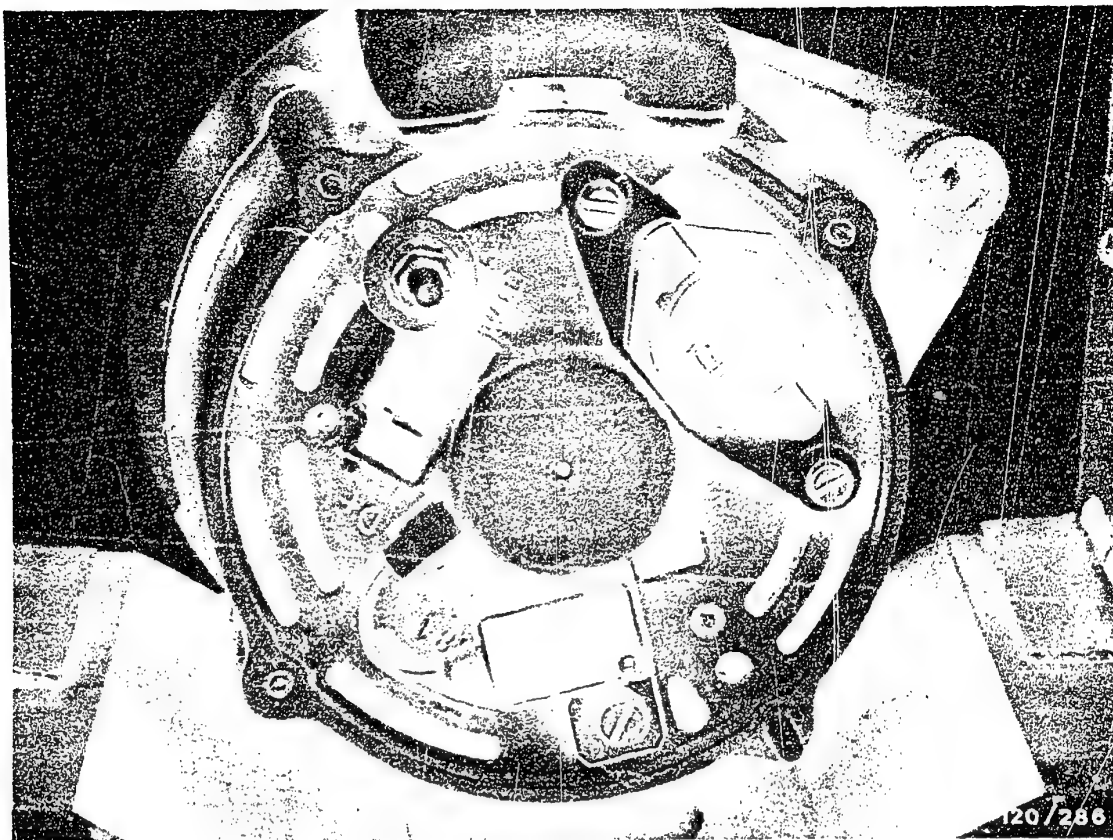
Place Woodruff key in groove. Slip new fan, right way round, onto shaft.

Mount parts of pulley in correct sequence on shaft.

Tighten the pulley using locking device KDLI 6006 and 22 mm box wrench.

Tightening torque: 35 ... 45 Nm.





Installing the regulator and suppression capacitor

Screw the regulator onto the rectifier bearing with 2 fastening screws.

Tightening torque: 1.6 ... 2.3 Nm.

Screw on the capacitor.

Tightening torque: 2.9 ... 4.1 Nm.

Plug the plug of the capacitor onto B+ terminal.

Note:

In the case of alternators with dust protection, insert the gasket between brush holder and collector-ring end shield precisely into the form fit of the collector-ring end shield.



10. Testing the alternator with regulator on the test bench

10.1 Test equipment and devices

Alternator test bench	EFLI 91	0	683	300	100
or	EFLJ 25 ..	0	680	110	...
or	EFLJ 70 A	0	680	104	...

or combination test bench
(only for loading up to
max. 43 A)

EFAW 275.. 0 681 107 ...

Mounting plate
for mounting swivel-arm-
mounted alternators on
alternator test bench

EFLJ 66/3

EFLJ 25, 70

Parts set
for mounting swivel-arm-
mounted alternators on
combination test bench

1 687 000 042

EFAW 275 ..

Alternator tester

WPG 012.00 0 681 101 403

For additional test:

Ignition oscilloscope

(all models)

or

Bosch Motortester

(all models)



Mounting on the test bench

Swivel-arm-mounted or flange-mounted alternators must only be mounted on the test bench using the appropriate clamping fixture.

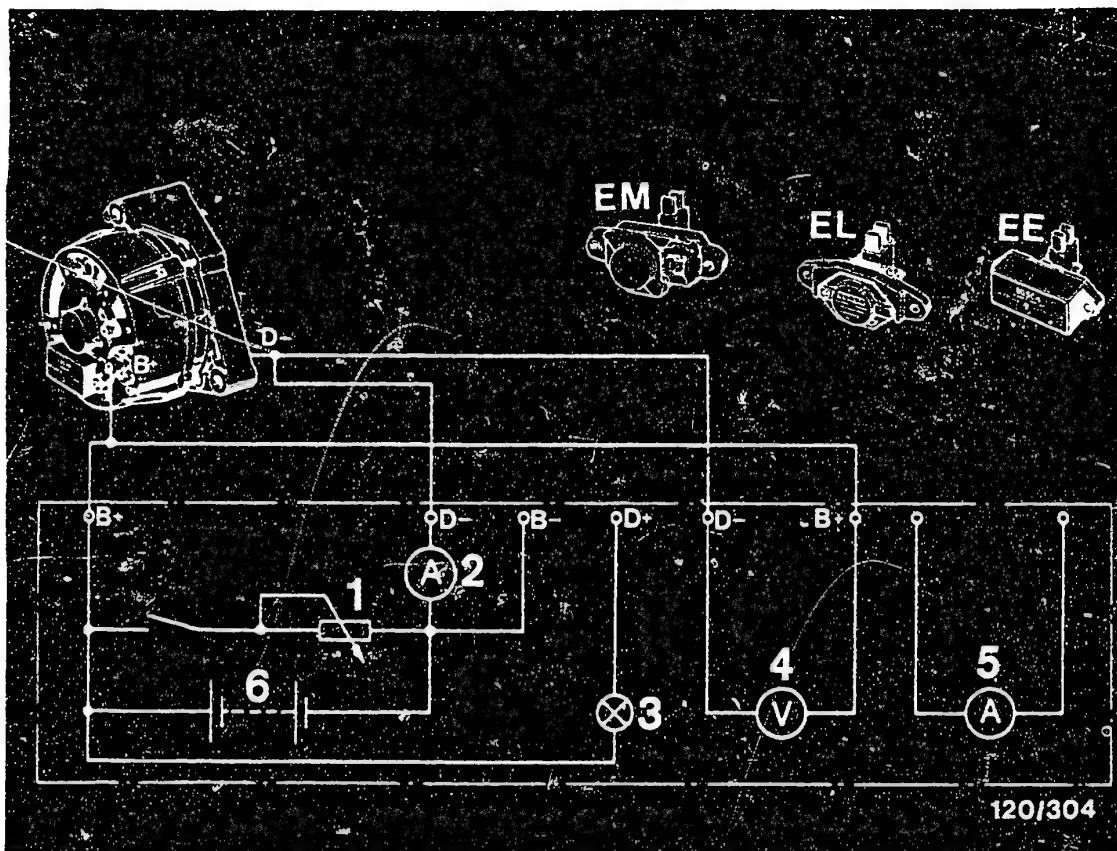
So that the power of the test-bench motor is sufficient, only test using the appropriate fan and pulley. Select the correct transmission ratio.

For test bench EFLJ 25.. the transmission ratio is 0.3:1. This means: If the alternator pulley is, for example, 100 mm \emptyset , use test-bench pulley with 350 mm \emptyset . For test bench EFLJ 70 A the transmission ratio is 0.4:1. This means: If the generator pulley is, for example, 100 mm \emptyset , use test-bench pulley with 250 mm \emptyset .

Note: If, at very high alternator outputs, the drive power of the test-bench motor is not sufficient, then only carry out the test to the extent that the test speed does not drop at the required test current.

The charge indicator lamp must be completely out when power-testing.





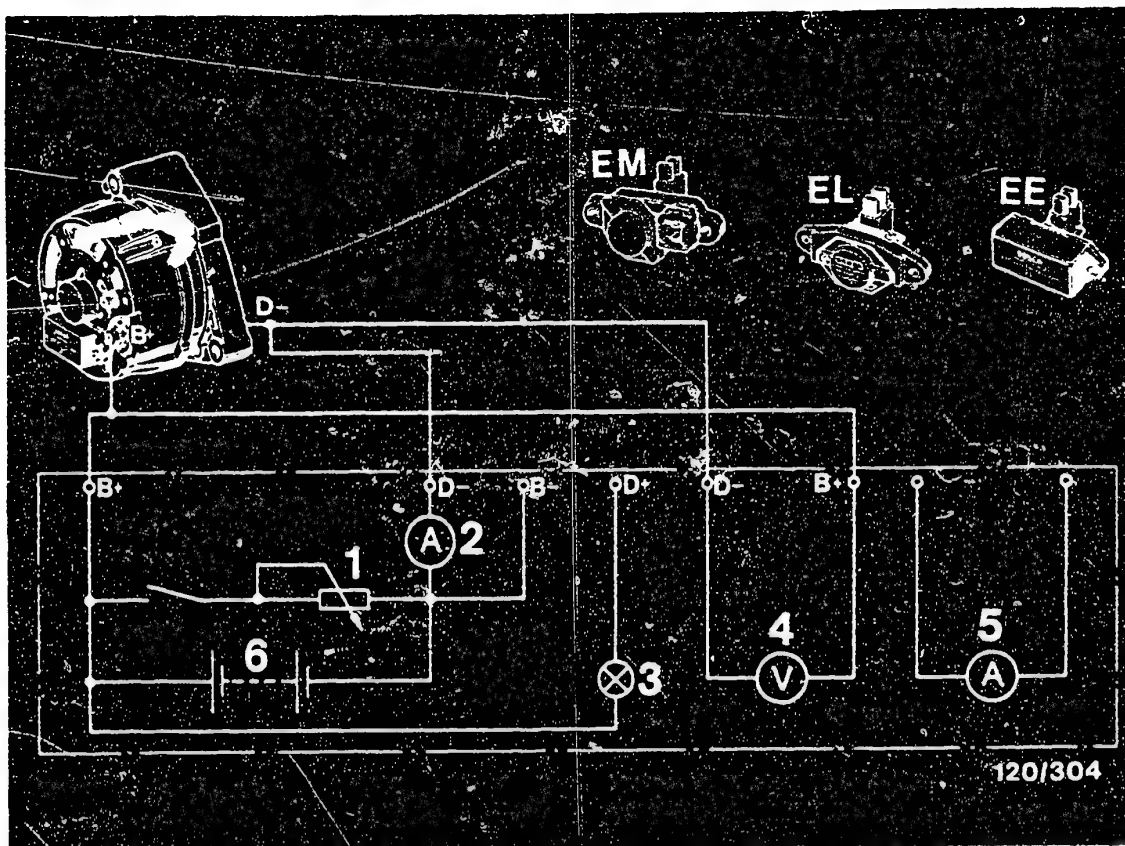
- | | |
|----------------------|-----------------------------------|
| 1 = Loading resistor | 4 = Voltmeter (regulated voltage) |
| 2 = Ammeter | 5 = Ammeter |
| 3 = Indicator lamp | 6 = Test-bench battery |

Connecting the alternator to the test bench

Connect the positive battery cable of the test bench to B+ of the alternator.

If the clamping table on the test bench is used as a ground cable, make sure that there are no contact resistances. It is therefore advisable in the case of high-power alternators to connect the negative battery cable of the test bench directly to the alternator. Connect voltmeter between B+ and B-.





- | | |
|----------------------|-----------------------------------|
| 1 = Loading resistor | 4 = Voltmeter (regulated voltage) |
| 2 = Ammeter | 5 = Ammeter |
| 3 = Indicator lamp | 6 = Test-bench battery |

Important:

All connections on the test bench must be properly made. When the alternator is running the connection between alternator and battery must not be disconnected since, otherwise, the semiconductors in the alternator and regulator may be destroyed.

Do not operate the alternator without the battery being connected.

If a direction of rotation is marked on the fan wheel or on the alternator, then the alternator must only be driven in this direction of rotation.



Testing the output

Please note. When testing the output, it is important to see that the rheostat built into the test bench is not switched into the circuit, because otherwise the charge indicator lamp will light up and give the impression that there is a fault in the alternator.

For testing purposes the alternator is brought up to operating temperature on the test bench, approx. 60°C. Select speed of 2000 min.⁻¹

Testing the output with regulator

Set regulated voltage on the test bench at 13 V. Bring the alternator up to the given test speed, then adjust the loading resistor until the given voltage is reached. The voltage shown must not be more or less than the alternator voltage.



Alternators 0 120 400 ... 0 120 489 ...	Power test	
	Speed min ⁻¹	Load A
K1 (RL) 7V50A17	1400	20
	1700	34
	4000	50
K1 (RL) 7V50A19	1300	20
	1900	34
	6000	50
K1 (RL) 14V28A22	1500	10
	2200	18
	6000	28
K1 (RL) 14V32A22	1500	10
	2200	21
	6000	32
K1 (RL) 14V35A20	1300	10
	2000	23
	6000	35
K1 (RL) 14V35A21	1500	12
	2000	20
	6000	35
K1 (RL) 14V35A22	1400	10
	2200	23
	6000	35



Alternators 0 120 400 ... 0 120 489 ...	Power test	
	Speed min ⁻¹	Load A
K1 (RL) 14V43A21	1250	10
	2100	28
	6000	43
K1 (RL) 14V45A20	1250	10
	2050	30
	3550	40 ⁹⁾
	6000	45
K1 (RL) 14V45A22	1400	10
	2200	30
	3450	40 ⁹⁾
	6000	45
K1 (RL) 14V45A24	1550	10
	2400	30
	3850	40 ⁹⁾
	6000	45
K1 (RL) 14V50A21	1350	10
	2150	33
	2850	40 ⁹⁾
	6000	50
K1 (RL) 14V50A22	1400	10
	2200	33
	2850	40 ⁹⁾
	6000	50

⁹⁾ On test bench EFAW 275 and KPS 001.00 test only up to this value.



Alternators 0 120 400 ... 0 120 489 ...	Power test	
	Speed min ⁻¹	Load A
K1 (RL) 14V55A20	1200	10
	2000	36 ⁹⁾
	2350	40 ⁹⁾
	6000	55
K1 (RL) 14V55A22	1350	10
	2200	36 ⁹⁾
	2450	40 ⁹⁾
	6000	55
K1 (RL) 14V65A21	1400	20
	2100	44
	6000	65
K1 (RL) 14V65A24 ¹¹⁾	1500	10
	2450	43
	6000	65
K1 (RL) 14V70A20	1500	27
	2000	46
	6000	70

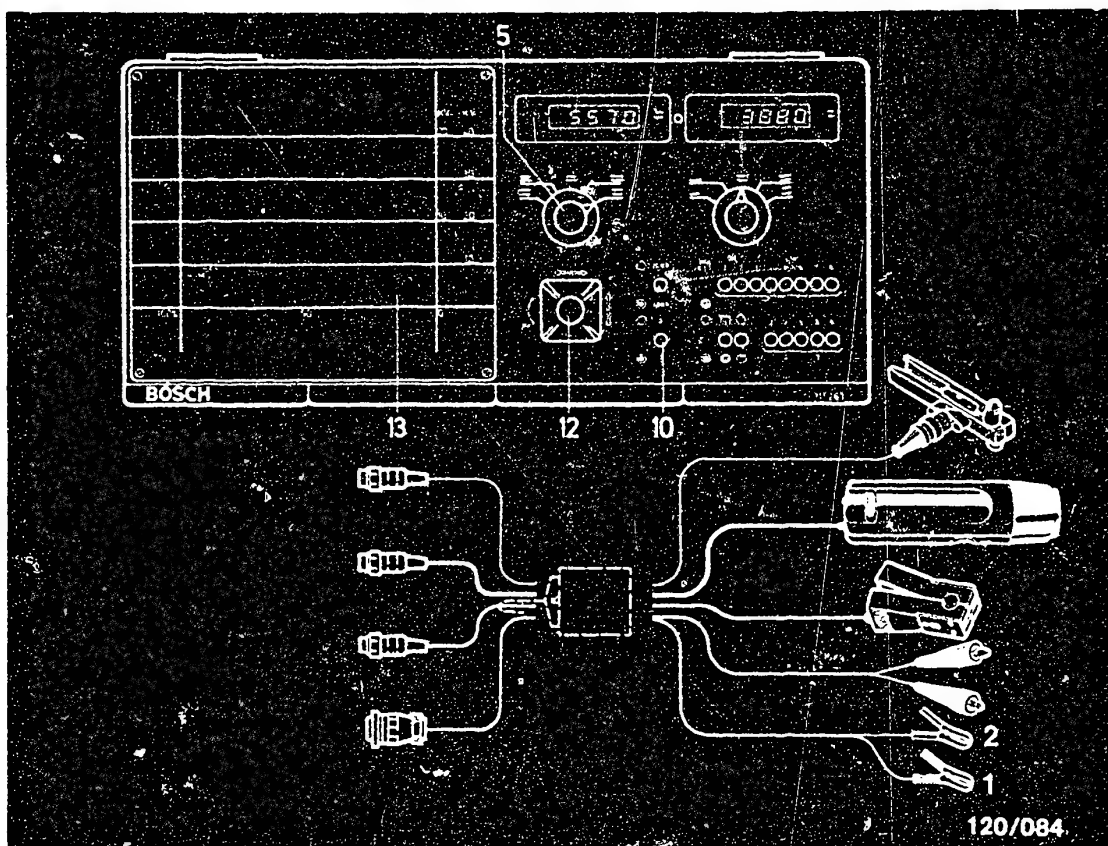
9) On test bench EFAW 275 and KPS 001.00 test only up to this value.



Testing the regulated voltage Load current ≤ 10 A

Regulator part number	Type code	Regulated voltage V
0 102 052 001	EE14V3	13.7...14.5
0 192 052 002	EE14V3	13.7...14.5
0 192 052 004	EE14V3	13.7...14.5
0 192 052 005	EE14V3	13.7...14.5
0 192 052 006	EE14V3	13.7...14.5
0 192 052 007	EE14V3	13.7...14.5
0 192 052 008	EE14V3	13.7...14.5
0 192 052 010	EE14V3	13.7...14.5
0 192 052 011	EE14V3	13.7...14.5
0 192 052 012	EE14V3	13.7...14.5
0 192 052 013	EE14V3	13.7...14.5
0 192 052 014	EE14V3	13.7...14.5
0 192 052 015	EE14V3	13.7...14.5
0 192 052 016	EE14V3	13.7...14.5
0 192 052 017	EE14V3	13.7...14.5
0 192 052 018	EE14V3	13.7...14.5
0 192 052 019	EE14V3	14.3...14.9
0 192 052 020	EE14V3	13.7...14.5
0 192 052 021	EE14V3	13.7...14.5
0 192 052 022	EE14V3	13.7...14.5
0 192 052 023	EE14V3	14.3...14.9
0 192 052 024	EE14V3	13.7...14.5
0 192 052 025	EE14V3	13.7...14.5
0 192 052 026	EE14V3	13.7...14.5
1 197 311 001	EL14V4B	13.7...14.5
1 197 311 002	EL14V4B	14.1...14.9
1 197 311 003	EL14V4B	13.7...14.5
1 197 311 004	EL14V4B	13.7...14.5
1 197 311 005	EL14V4C	13.7...14.5
1 197 311 006	EL14V4B	13.7...14.5
1 197 311 007	EL14V3C	14.1...14.9
1 197 311 008	EL14V3C	14.1...14.9
1 197 311 009	EL14V4B	13.7...14.5
1 197 311 010	EL14V4B	13.7...14.5
1 197 311 011	EL14V4C	13.7...14.5
1 197 311 100	EM14V4C	14.3...14.6



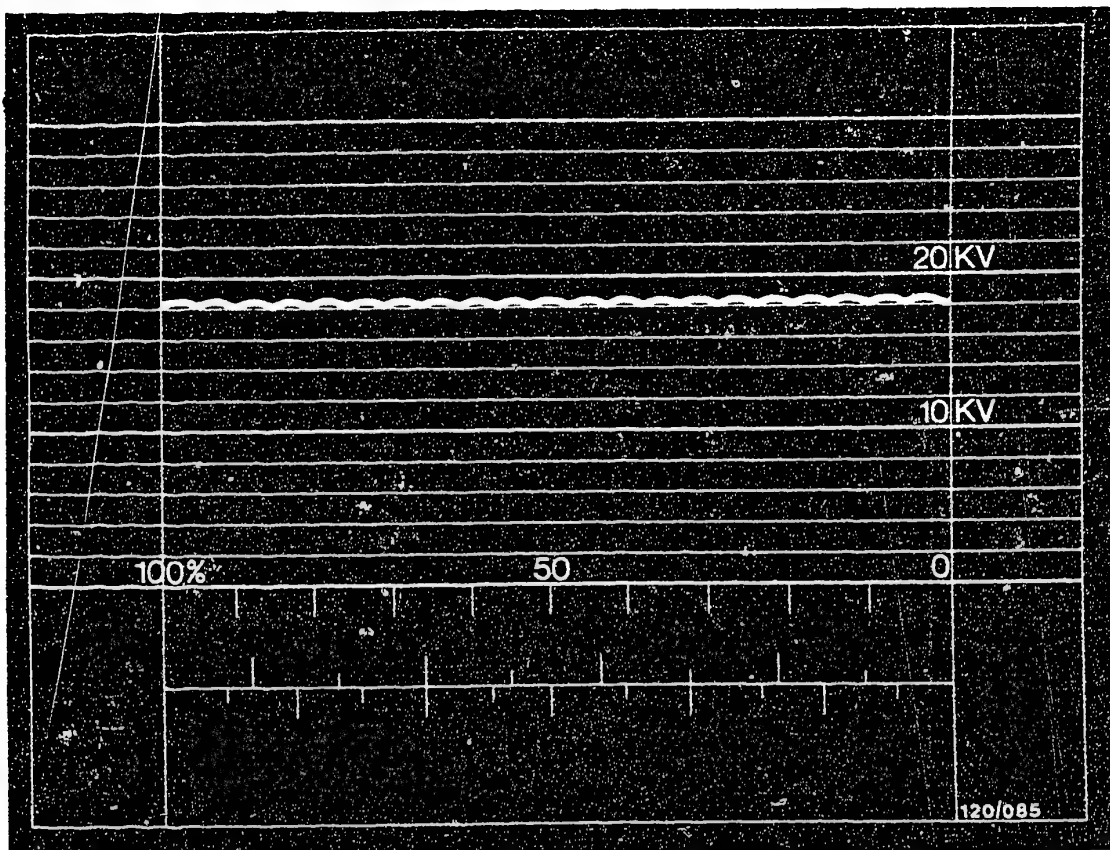


10.2 Testing with the oscilloscope

Connect the oscilloscope (MOT 002.00) to the alternator using the test lead supplied.

Red clip (1) to D+ terminal.

Black clip (2) to B- terminal (ground).



Adjusting and evaluating the oscilloscope displays

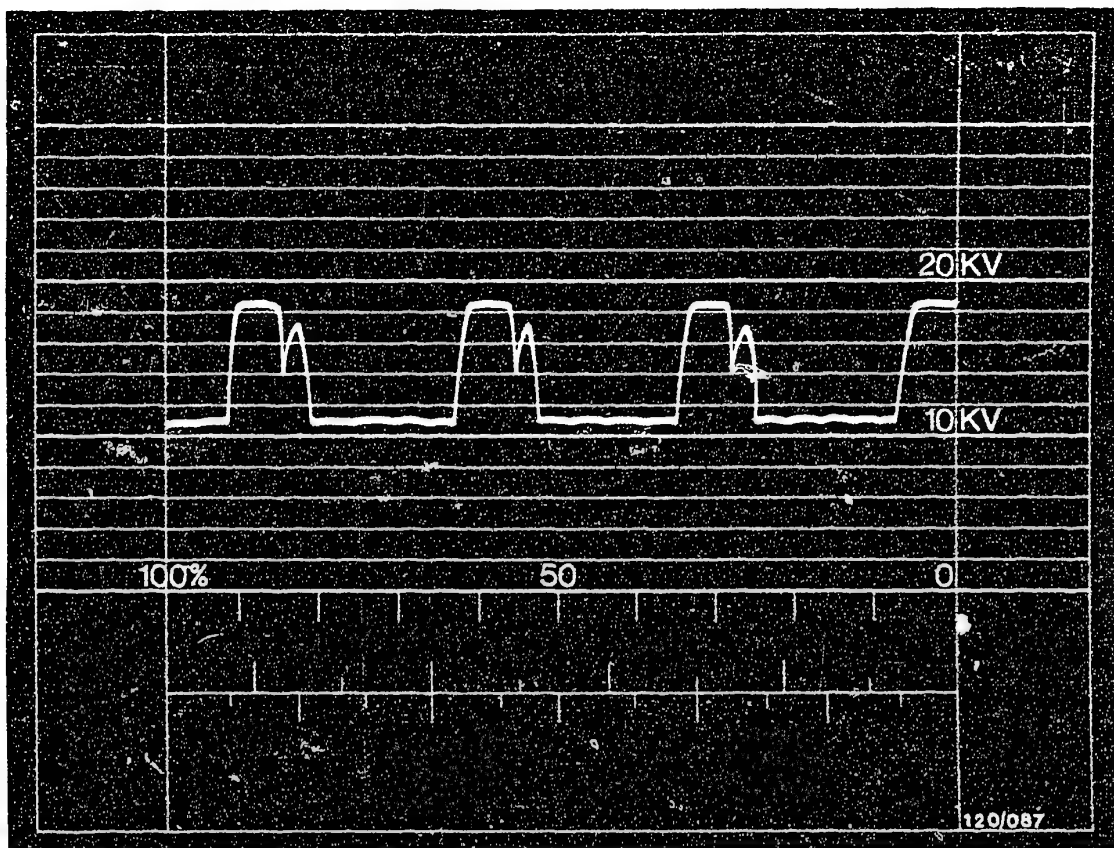
If the alternator is in proper working order, the above display is obtained. The DC voltage supplied has a slight ripple content. The oscilloscope display may have small spikes superimposed on it when the regulator is in operation. The regulator can be "shut down" by connecting in a load (e.g. loading resistor).

Adjust the height of the display so that the ripple content is between two kV lines..

In order to compare such displays, the respective display must be adjusted using the vertical controller of the oscilloscope so that it more or less fits in between the 10 and 20 kV lines.

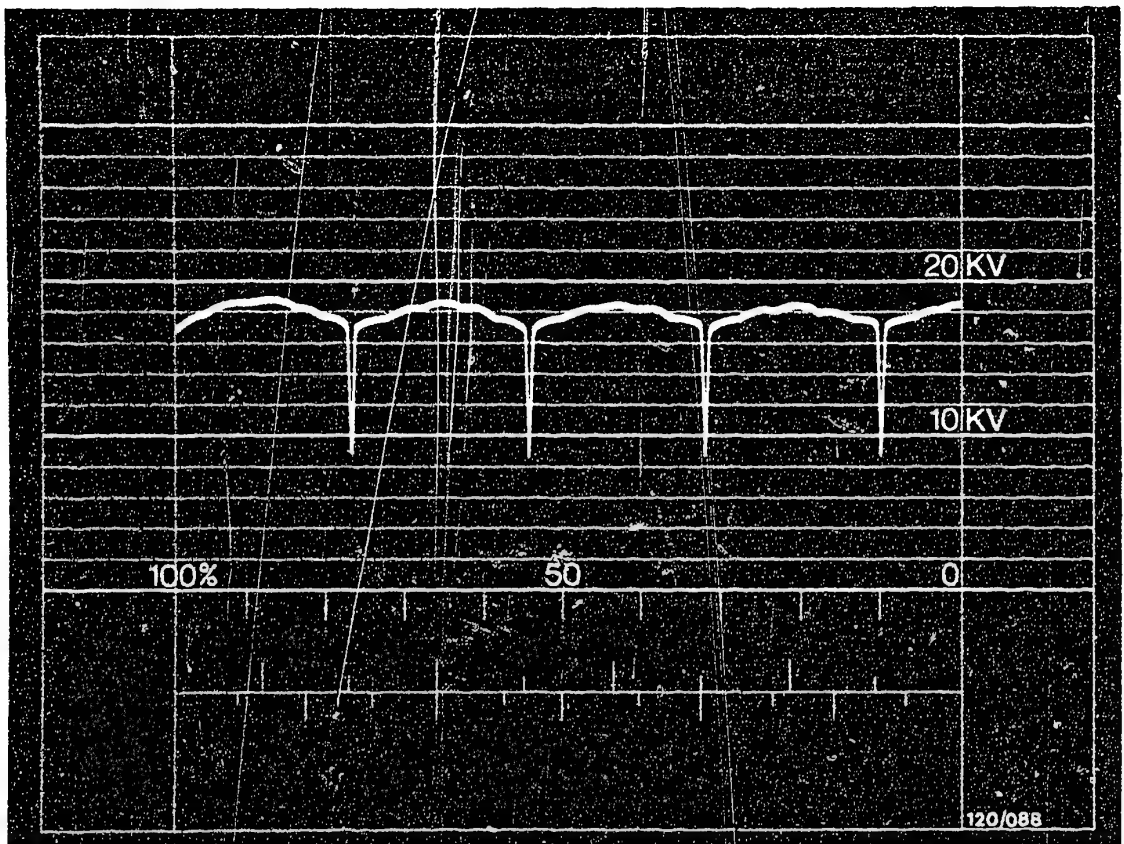
Note: It is also possible for several defects to occur together.





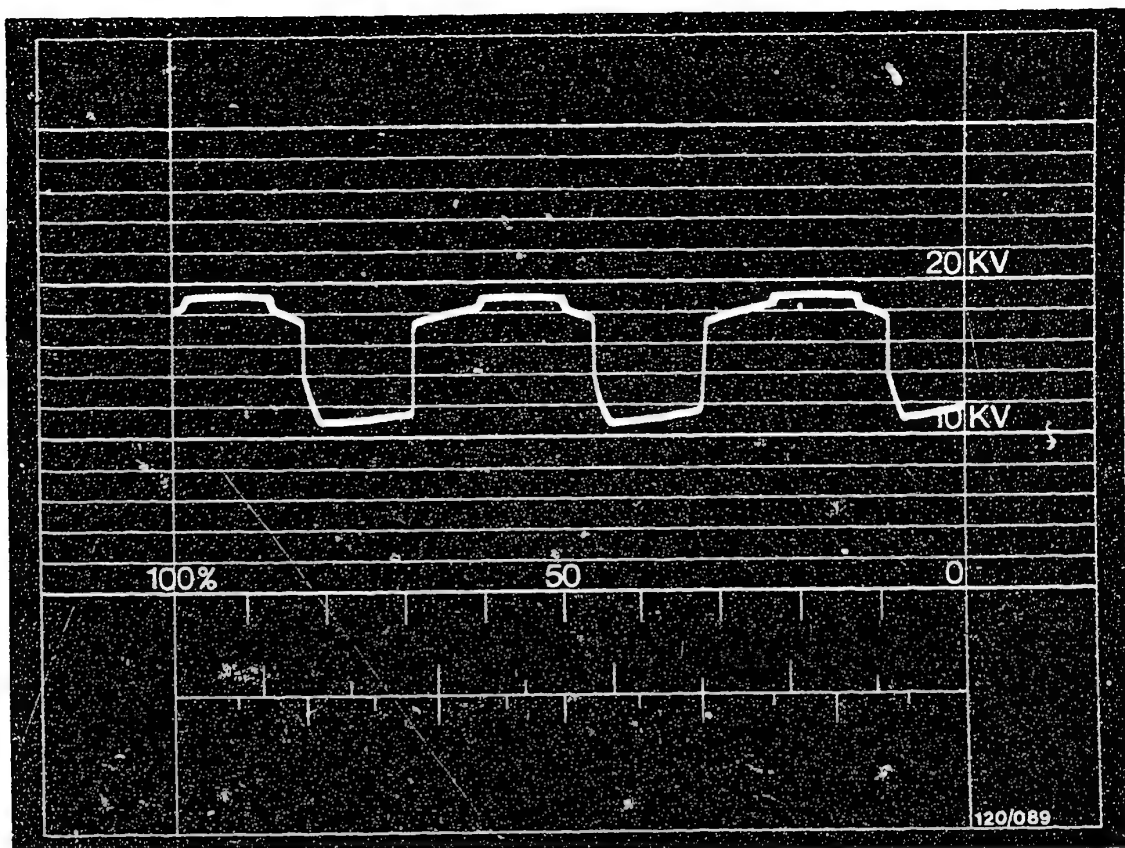
Oscilloscope display shows open circuit in a positive diode

If several diodes are connected in parallel in an alternator, this oscilloscope display only appears when all diodes have an open circuit.

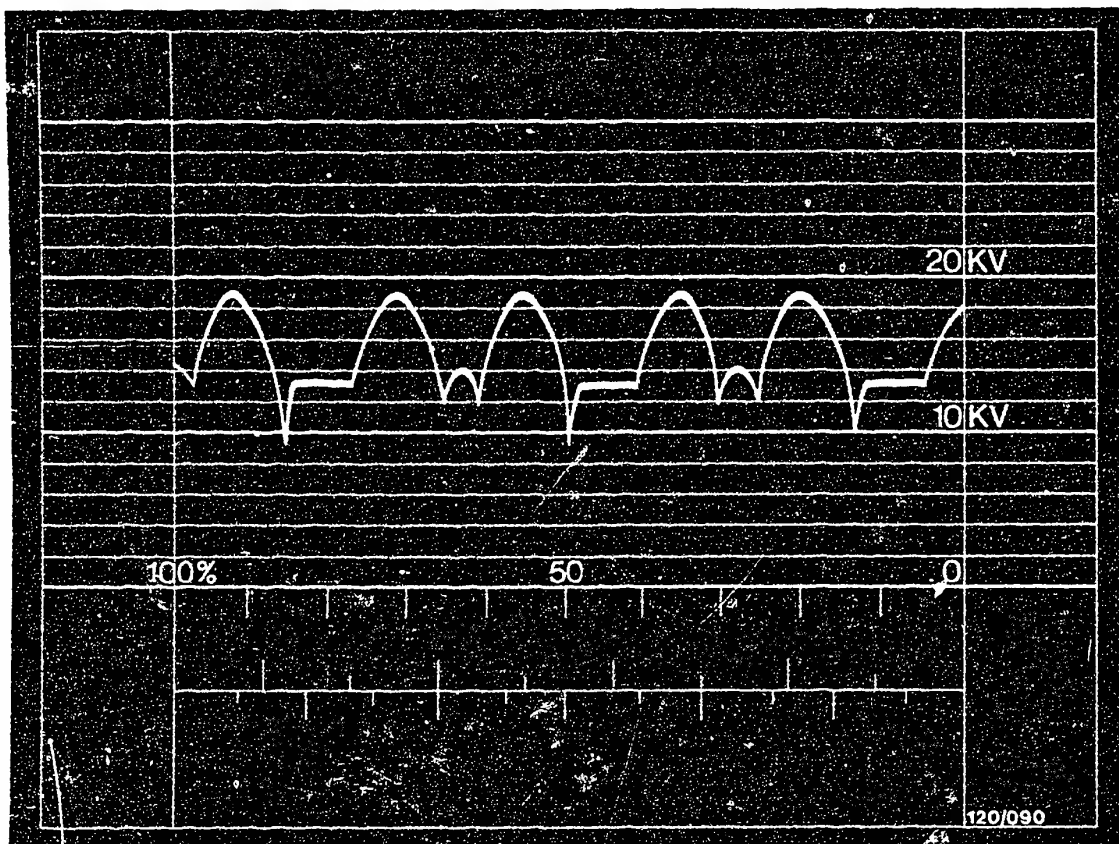


Oscilloscope display shows open circuit in a negative diode

If several diodes are connected in parallel in an alternator, this oscilloscope display only appears when all diodes have an open circuit.

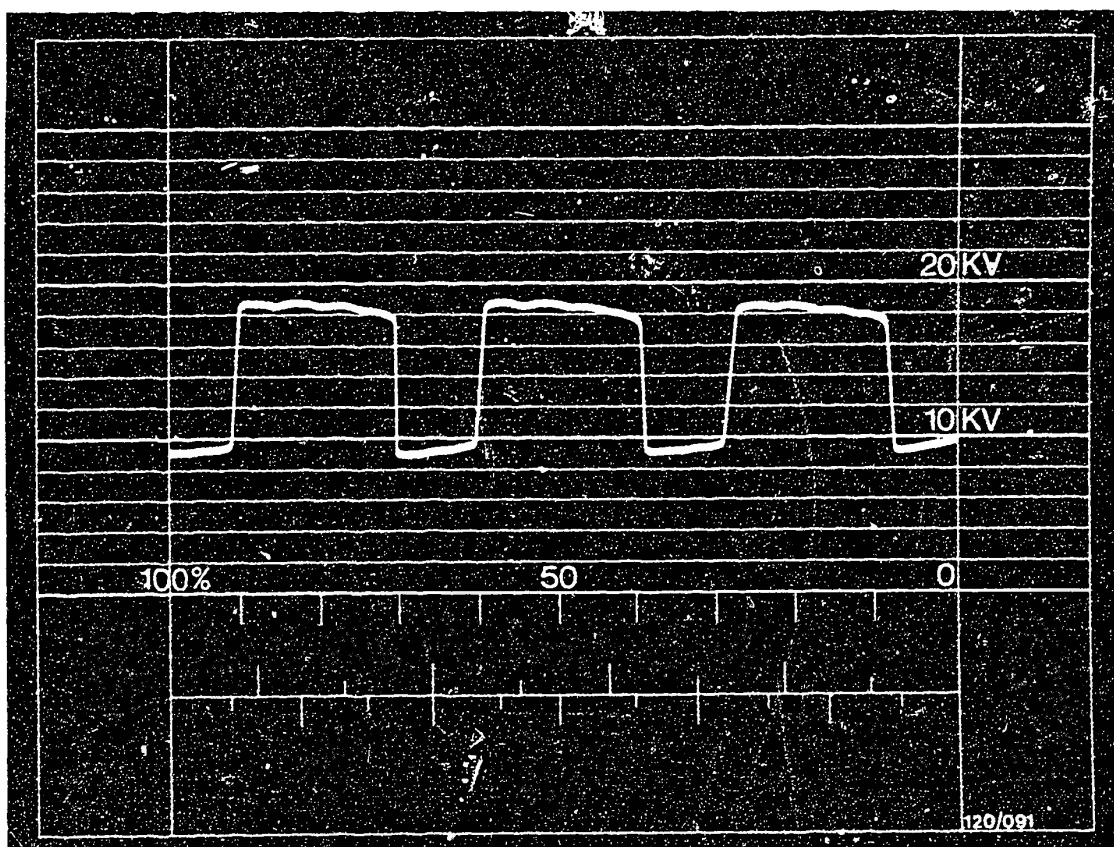


Oscilloscope display shows short circuit in an exciter diode



Oscilloscope display shows short circuit in one or more positive diodes.





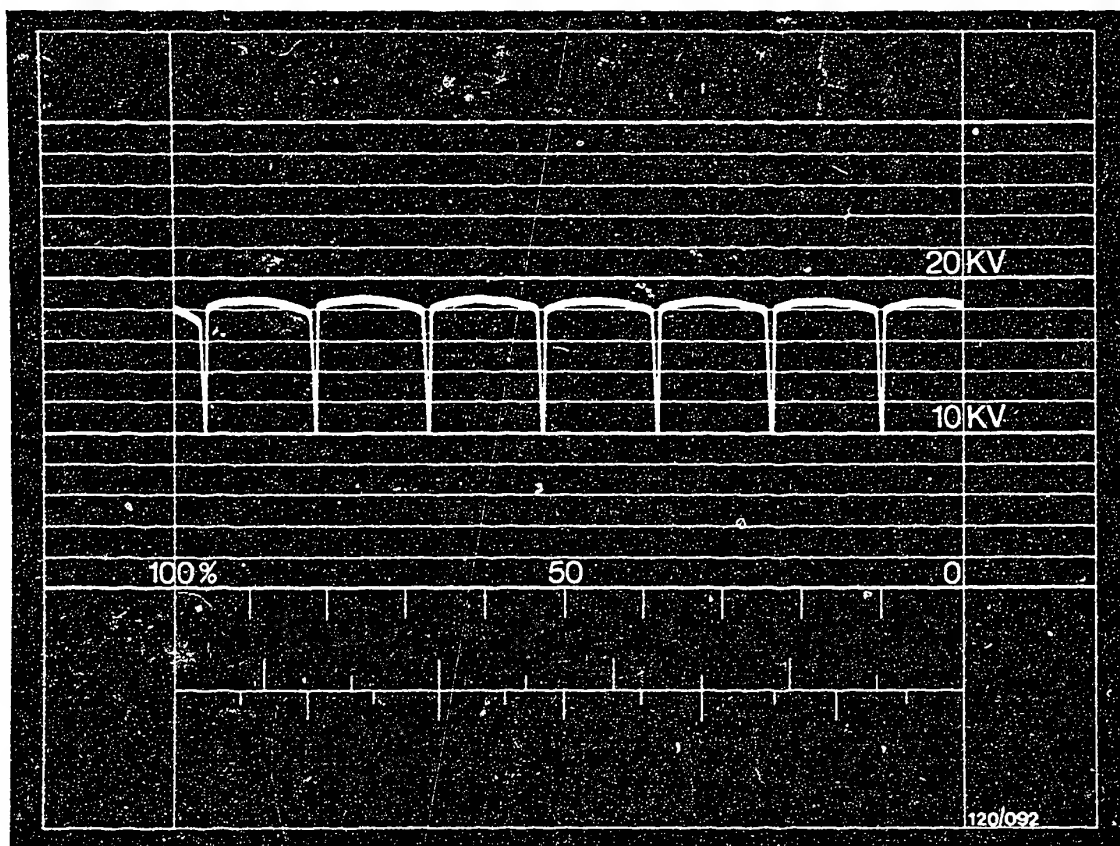
Oscilloscope display shows short circuit in one or diodes.

D17

Testing

Alternators 0 120 400..., 0 120 489..., 14V





Oscilloscope display shows phase defect (open circuit)



After-sales Service

Technical Bulletin

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Parts Cleaning

Use of highly-inflammable cleaning agents, or cleaning agents which are dangerous to health

Gen.

VDT-I-Gen./18 En
7.1978

When cleaning parts which come from vehicle electrical products prior to repair, it is permitted to use the following cleaning agents: Benzine, trichloethylene (tri) and perchloroethylene (per). These are dangerous, and must be handled with appropriate care. The relevant safety regulations in West Germany are:

Regulations concerning work with inflammable liquids
(VbF) issued by the Federal Labor Ministry (BmA).

Safety regulations for the use of chlorinated hydrocarbons

as applied to the works ZH1/222

as applied to personnel ZH1/119

as issued by the Federation of the Trade co-operative Associations
(Central Association for Accident Prevention and Industrial Medicine)
Langartweg 103, D-5300 Bonn 5).

1. Benzine, acetone and ethanol (ethyl alcohol) are inflammable liquids and their mixtures with air are dangerous due to the risk of explosion. Parts washing may only take place in tanks or containers solely intended for this purpose and equipped with a "melt" safety device for the lid which, in case the liquid catches fire, causes the lid to close automatically and smother the fire. In the case of larger containers (exceeding 500 x 500mm) some form of suction extraction must be provided.

- 1.1 Generators, alternators, wiper motors, small-power motors and other electrical equipment for installation in vehicles are, in ever increasing numbers, being equipped with capacitors having long storage times (e.g. for interference-suppression purposes in radio-receiver or transmitter installations).

When washing such parts, it is possible that a capacitor discharge can occur when the part is immersed in the cleaning agent. This can lead to an inflammable liquid catching fire. For this reason, parts on which a capacitor is fitted are only to be washed in trichlorethylene (tri) or perchloroethylene (per).

- 1.2 In the case of starting motors, it has already been pointed out in earlier repair instructions that the parts should be thoroughly dried after washing in benzine, this applies particularly to windings. With sliding-gear starting motors, the first test run after washing out must be performed without the closure cap in order to avoid the possibility of explosion.

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L1

Technical Bulletin

Alternators 0 120 400..., 0 120 489..., 14V



2. Trichlorethylene (tri) and perchloroethylene (per) are both liquids whose vapors have a stupefying effect, and which are dangerous to health if inhaled over long periods. Tri vapor is heavier than air, and therefore especially dangerous at floor level. Gloves and goggles are to be worn when washing out parts in these liquids.

If cleaning of parts is carried out regularly, or continuously, in trichlorethylene only containers or tanks intended solely for this purpose are to be used, and the suction extraction device is to be switched on. When washing parts do not bend over the container.



After-sales Service

Technical Bulletin

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Sheet Steel Fans for Alternators of Sizes G and K

12

VDT-I-120/103 B
9.1976

Fan discs, primarily produced from galvanized sheet steel, are subjected to varying loads during operation, the magnitude of which depends on the driving habits of the operator.

Please note that, as a safety measure, when repairing or replacing alternators that have been used for more than 100,000 km or for 2,000 operating hours, new sheet-steel fan discs should be installed.

When doing this, be sure that the direction of rotation of the fan disc, as well as the sequence and position of accessories, are correct.

Tightening torque for the fastening nut: 35 - 45 Nm.

In case of inquiry, please contact your authorized representative.

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L3

Technical Bulletin

Alternators 0 120 400..., 0 120 489..., 14V



After-sales Service

Technical Bulletin

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Steel sheet fan wheels for alternators

Assembly instructions

12

VDT-I-120/103 B
Suppl. 1
7. 1977

Summary

When assembling the fan wheel and pulley, attention is to be paid to the correct sequence and position of the accessories, in particular the new supporting plate. See Figs. 1 ... 4 for assembly examples.

Details

Since the end of 1976 supporting plate 1 120 140 009 has been mounted between the fan and pulley assembly within the scope of further development for various alternators provided with steel sheet fan wheels.

The outside diameter of this new supporting plate (item a) is 55 mm. The 5 mm wide and approx. 0.3 mm high stamping on the rim presses against the fan. A slotted washer (item b) or the pulley itself is mounted directly on the side facing the pulley, depending on the alternator model. Care is to be taken that the 26 mm diameter collar of the slotted washer or pulley presses against the supporting plate.

In the case of steel sheet pulleys a second slotted washer (item c) is mounted between the pulley and spring lock washer. The spring lock washer or spring washer, as well as the fastening nut remain unchanged.

The tightening torque for the entire assembly continues to be 35 ... 45 N.m (approx. 3.5 ... 4.5 kgf.m).

Tool KDL 6006 is required to hold the pulley when tightening the nut.

Under no circumstances should the fan wheel be locked using a screwdriver or similar. Bent or damaged fan blades result in damage to the alternator.

In the case of alternators which are provided with the supporting plate ex-works, this plate must also be installed when repair work is performed. Basic information regarding use is provided by the service part documents and packing notes for service part packages. Supporting plate 1 120 140 009 is included in the scope of delivery of the pulley.

The complete assembly is matched to the alignment of the V-belt. Modifications or assembly errors may cause damage.

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L4

Technical Bulletin

Alternators 0 120 400..., 0 120 489..., 14V



Careful replacement of the steel sheet fan wheel when repairing or exchanging the alternator after operating for more than 100 000 km or 2000 running hours is still required.

Assembly examples for supporting plate 1 120 140 009

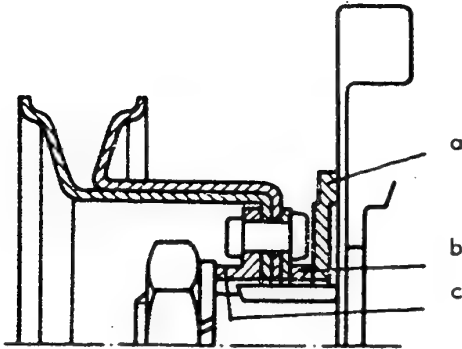


Fig. 1 Single-piece steel sheet pulley with deep hub

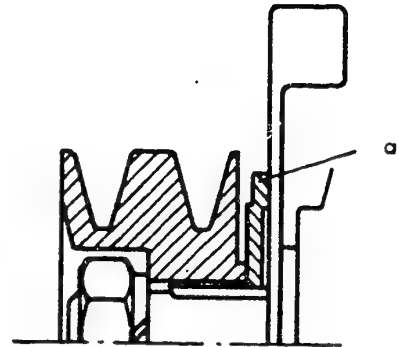


Fig. 2 Solid single-piece pulley

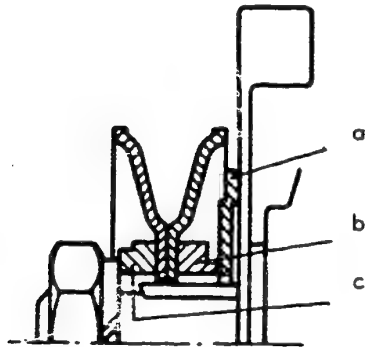


Fig. 3 Two-piece steel sheet pulley

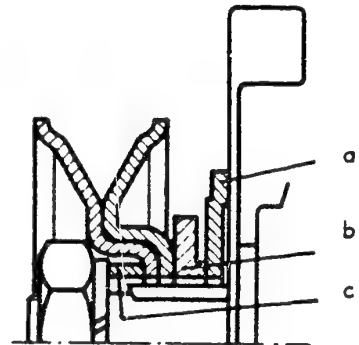


Fig. 4 Offset two-piece steel sheet pulley

Designation of individual components

- a Supporting plate 1 120 140 009
- b Rear slotted washer
- c Front slotted washer



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EXTERNALLY MOUNTED TRANSISTOR REGULATOR 14 V ..

1 197 311 ..

12

VDT-I-120/105 En

2.1980

Supersedes Ed. 9.78

In addition to the already familiar EE externally mounted transistor regulators 0 192 052 .., the regulator 1 197 311 .. (EL 14 V ..) is finding increased application on a variety of different alternator models.

In case of complaints regarding the EL regulator 1 197 311 001/002 - for alternator collector ring with 32 mm diameter - the EL regulator 1 197 311 001 as well as the EE regulator 0 192 052 006 can be used as replacements.

When fitting an EE regulator, it must be taken into account that the housing is larger, that is, fitting space must be available.

The EL regulator 1 197 311 003 and ..004 for alternator collector rings with a diameter of 28 mm can only be replaced by the model 1 197 311 003.

This regulator is fitted with a 68 Ω resistor between D+ and D-.

Further EL regulator models not listed here, and their replacements, are to be found in the EE microfiches of the alternators concerned.

It is not possible to fit a regulator with lengthened brush holder (for alternators with collector-ring diameter 28 mm) to alternators with collector-ring diameter 32 mm. Neither can the regulator with lengthened brush holder for 32 mm diameter be fitted to the 28 mm dia. model.

The production of alternators with a collector-ring diameter of 28 mm instead of 32 mm is increasing.

Warranty procedure

The normal warranty conditions apply to the regulator 1 197 311 .. (EL 14 V ..). In the case of justified complaints, the precise part number of the alternator is to be entered in the column for the damaged product.

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Technical Bulletin

Alternators 0 120 400.., 0 120 489.., 14V



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SOLUTION TO THE WIRING-HARNESS REPAIR PROBLEM

12

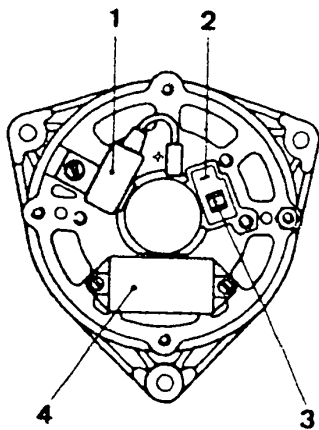
on alternators with attached-type regulators
and plug-in connection for B+ and D+

VDT-I-120/106 En
3.1979

On most vehicles the cable connections from the alternator/generator are welded to the wiring harness plug. This means that if the plug is damaged, a repair cannot be carried out.

In order to make repair possible, therefore, we have introduced a plug housing with 3 blade terminals into the program. Part Number: 1 297 011 001. Remove the old plug-in connection, strip about 1 cm of insulation from the wire and crimp on the new blade terminals using the Eisemann crimping tool. Fit the blade terminals in the plug housing.

This parts set will be included in the service-parts lists for the generators/alternators in question.



- 1 = Suppression capacitor
- 2 = Blade terminal 6.3 x 0.8 (D+)
- 3 = Blade terminals 9.5 x 1.2 (B+)
- 4 = Transistor regulator

Fig. 1 Plug-in connection

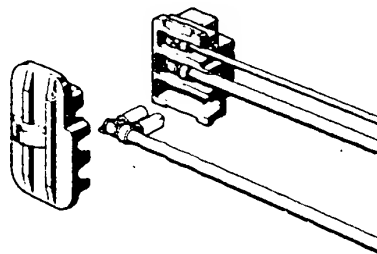


Fig. 2 Plug housing with
blade terminals

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Alternators 0 120 400..., 0 120 489..., 14V



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ALTERNATORS 0 120 ..

12

VDT-I-120/107 En

9.1979

Alternator operation without battery

General

Unless special measures are taken, alternators are not to be operated without the battery connected because otherwise this can lead to the destruction of semiconductor components in the regulator, alternator or vehicle electrical system.

In the case of special-purpose vehicles, auxiliary or stationary equipment, or vehicle export, it can be necessary for the alternator to operate without battery - with or without power output.

With systems where the regulator is mounted separately from the alternator, the alternator is placed out of operation before starting by open-circuiting the line between it and the regulator. Power output is now impossible.

This method cannot be used with systems having an attached-type regulator. In such cases, the following methods are used. Details can be taken from the product specifications.

1. Systems with increased voltage-proof characteristics

A variety of vehicle manufacturers order such systems because during shipping it can occur that operation takes place without battery. In such exigencies, power output is possible depending upon alternator speed. These measures protect the alternator and regulator but not the loads.

2. Zener diode 1 127 328 .. for 14 V alternators and max. 35 A

This Zener diode is connected to Terminal B+ of the alternator. If the voltage rises above the response voltage of the Zener diode this conducts and the voltage peak is conducted away through the diode heat sink to the alternator housing. In this way semicon-

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Alternators 0 120 400..., 0 120 489..., 14V



ductors in the alternator and regulator are protected against voltage peaks and if necessary the system can deliver power. If required, this Zener diode can be fitted as series equipment on new alternators or can be retro-fitted. Connection in parallel or series of these Zener diodes for the purpose of increasing the power is not possible.

Notes on testing are contained in Instructions VDT-W-120/300.

Burnt-out connections between Zener diode and alternator B+ are the result of false polarity during battery change, use of auxiliary starting aids or operation with 24 V etc. Warranty claims are therefore to be rejected.

3. Systems with over-voltage protection devices fitted

For years, such devices (OSG) have been available either integrated in the regulator e.g. 0 192 083 .. or separate 0 192 900 .. for use in 28 V systems.

When voltages occur in excess of the OSG response voltage, the Terminals D+ and D- are connected together by the OSG. The alternator is short-circuited and cannot self-excite. This means that resultant damage in the vehicle electrical system due to excessive alternator voltage is avoided.

As long as the OSG does not conduct, without battery connected, the alternator can deliver power.

4. Short-circuit capsule 1 120 505 000 for K1, N1 and T1 alternators

In order that the alternator does not self-excite during operation without battery, Terminals D+ and D- are connected together. At customer request, certain alternator models are equipped at the works with a short-circuit capsule connected to Terminal D+ for this reason. This enables engines and vehicles to be tested on dynamometers etc. without the battery being connected. Power cannot be taken from the alternator.

After the battery is connected the capsule is removed so that the system is ready for operation. If, subsequently, operation without battery is required, D+ and D- must be connected together again.

Details regarding the Part Numbers of the products dealt with in this Bulletin can be requested from your local Bosch representative.



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ALTERNATOR

VDT-I-120/111 En

for BMW boat engines with ignition safeguard

2.1980

Part No. 0 120 489 890, ..981

General

The US Coast Guard Regulations for gasoline-driven boat engines demand a so-called "ignition safeguard" in the products for the electrical engine equipment (including the alternator). This is to make sure that explosions do not occur when operated in a combustible atmosphere.

"Ignition safeguard" characteristics

The following special precautions have been introduced in alternators with "ignition safeguard":-

a special shaped cover disc on the rotor;

modified shoulder on the rotor side of the rectifier.

both these measures result in a lengthened air gap in the labyrinths between the rectifier and the rotor;

additional seal between the regulator 0 192 052 021 and the brush holders.

Workshop instructions

When doing repair work on alternators, e.g. when replacing the rectifier, you should make sure that the centre bore in the rectifier housing is concentric with the bearing seat in the collector-ring end shield.

After soldering the new soldered and welded points should be insulated with lacquer coating no. 190 from the firm of Dr. Beck, Postbox 180-280, D-2000 Hamburg or with insulating lacquer of the insulating classes A, E and B as per IEC 85/VDE 0 530 and per temperature index 130...140 according to IEC 216. The drying out time for the lacquer is approx. 24 hours at room temperature.

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Alternators 0 120 400..., 0 120 489..., 14V



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DAMAGE TO THE DRIVE-END-BEARING HOUSING
BY PRESSING OUT THE ROTOR ON VW AND
AUDI ALTERNATORS

VDT-I-120/115 En

3.1981

Alternators 0 120 4..

Due to the conversion of certain K-alternators for VW and Audi to drive-end bearings press-fitted to the shaft, the drive end shield or support plate which is screwed from the inside on these alternators, can be damaged when the rotor is pressed out.

When pressing out the rotor a three-arm puller, part no. 57-036 from the firm of Schrem in 7928 Giengen 1, Postfach 1504, should be used.

Apply the puller to the drive-end bearing in such a manner that the arms grip behind the support plate. Only in this way can one guarantee that the fastening screws will not be broken off when the rotor is pressed out.

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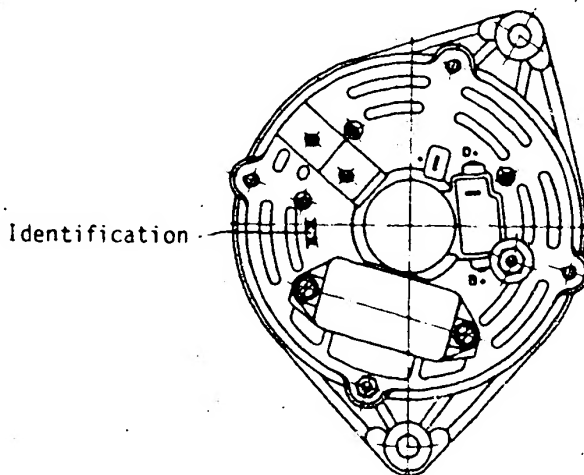
ADDITIONAL IDENTIFICATION OF
ALTERNATORS 0 120 ..

VDT-I-120/116 En

4.1981

Since date of manufacture FD 143 (March 1981) the alternators fitted with stick-on nameplates have received an additional identification. This takes the form of stamping the last 4 figures of the appropriate part number on a suitable place on the front of the collector-ring end shield. The figures are 4 mm high. The exterior characteristics of the alternators make it possible to find out the remaining 6 figures of the part number.

Since the introduction of this additional identification, the part number of an alternator can be ascertained even if the nameplate is missing or has become illegible. This makes it easier to find technical data in such cases, as well as to quote the full part number in correspondence or in guarantee claims.



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Alternators 0 120 400..., 0 120 489..., 14V



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